



Canadian
Coast Guard

Garde côtière
canadienne

TP9172E

Canadian Coast Guard
Research and Development

Annual Report

1987 / 88



Vol.1 Report

Canada





Canadian
Coast Guard

Garde côtière
canadienne

90-02951/

R&D PROJECT REPORT DOCUMENTATION FORM

1. Transport Canada Report No. TP 9172 E/F - Vol. I	2. CCG Project No.	3. Recipient's Catalogue No.	
4. Title and Subtitle Canadian Coast Guard Research and Development ANNUAL REPORT 1987/88		5. Report Date November 1, 1988	
		6. Performing Organization Report No.	
7. Author(s)		8. Transport Canada File No.	
9. Performing Organization Name and Address		10. DSS File No.	
		11. DSS or Transport Canada Contract No.	
12. Sponsoring Agency Name and Address CCG		13. Type of Report and Period Covered	
		14. Sponsoring Agency Code	
15. Supplementary Notes		16. CCG Project Officer	
17. Abstract Annual Report on 1987/88 CCG R&D Activities Vol. I - Overview of CCG R&D Program			
18. Key Words Marine Research and Development, CCG Research Program, Arctic Marine Research, Procurement Related Research, AWRSP, FCIP, RD&ES, PERD, UP's		19. Distribution Statement	
20. Security Classification (of this report) Unclassified	21. Security Classification (of this page)	22. No. of Pages	23. Price



Garde côtière
canadienne

Canadian
Coast Guard

FORMULE DE DOCUMENTATION POUR RAPPORT DU PROJET (R&D)

1. N° du rapport Transports Canada TP 9172 E/F - Vol. 1	2. N° de l'étude de GCC	3. N° de catalogue du destinataire
4. Titre et sous-titre Recherche et Développement de la Garde côtière canadienne Rapport annuel de 1987/88	5. Date du rapport novembre 1988	6. N° du rapport de l'organisme exécutant
7. Auteur(s)	8. N° de dossier Transports Canada	
9. Nom et adresse de l'organisme exécutant	10. N° de dossier - ASC	11. N° de contrat - ASC ou Transports Canada
12. Nom et adresse de l'organisme parrain GCC	13. Genre de rapport et période visée	14. Code de l'organisme parrain
15. Remarques additionnelles	16. Agent de projet de GCC	

17. Résumé

Recherche et Développement de la Garde côtière canadienne
Rapport annuel de 1987/88

Vol. 1 Rapport

18. Mots-clés Recherche et Développement dans le domaine maritime, Programme de recherche de la GCC, Recherche Maritime dans l'Arctique, Recherche concernant les achats, PEREA, PICF, Plan de RD&ET, PERD, PS	19. Diffusion		
20. Classification de sécurité (de ce rapport)	21. Classification de sécurité (de cette page)	22. Nombre de pages	23. Prix

CANADIAN COAST GUARD
RESEARCH & DEVELOPMENT
ANNUAL REPORT
1987/88

CONTENTS

VOLUME I

INTRODUCTION	1
SECTION I	5
- Marine Group Mission	
- Participating CCG Branches and Branch R&D Objectives	
- Internal Funding Sources	
- External Funding Sources	
SECTION II	10
- 1987/88 Program Highlights	
- Program Expenditure Summary	
SECTION III	12
- Future Goals	
SECTION IV	17
- List of Reports (this section also appears as Appendix G of Volume II)	

CONTENTS

VOLUME II

Appendix A

Arctic Waters Regulatory Studies Program (AWRSP)	2
List of Projects	
Key Result Area: Arctic R&D - Safety & Regulatory	5

Appendix B

Fleet Capital Investment Plan (FCIP)	
R&D by KRA/Fleet Program Area	23
List of Projects	
KRA/Fleet Program Area: B.1 Fleet: Aviation	25
B.2 Fleet: Ships	27

Appendix C

Research & Development and Engineering Studies (RD&ES) Plan by Key Result Area	44
List of Projects	
C.1 Short Range Aids to Navigation	48
C.2 Ship Safety	72
C.3 Safety & Public Correspondence Communication	86
C.4 Vessel Traffic Services	93
C.5 Emergencies	98
C.6 Waterways Development, Maintenance & Protection	104
C.7 Search & Rescue Operations	107
C.8 Direction and Administration	112

Appendix D

Program Energy R&D (PERD)	115
List of Projects	117
Key Result Area: Arctic R&D, Safety & Regulatory	

Appendix E

Unsolicited Proposals	123
List of Projects	

Appendix F

R&D Management Publications	127
-----------------------------	-----

Appendix G

List of Reports	129
-----------------	-----

INTRODUCTION

The functional components and associated Crown Corporations of the Marine Group conduct and participate in R&D programs as an integral part of fulfilling their respective missions. In addition, R&D efforts are used to support the interests of other members of the Canadian marine community, to promote maximum Canadian industrial benefits and to meet other federal economic and regional objectives as appropriate.

Coast Guard, with its broad responsibilities for the regulation and certification of commercial vessels and for the provision of safe navigable waterways, conducts the largest R&D program of the Marine Group components.

Various special sources of funds are available to the Marine Group components to support their R&D programs. The major funding is from within the Marine Group reference level and from special controlled allotments. The remainder is obtained from several interdepartmental R&D programs.

The 1987/88 R&D Annual Report is the second comprehensive annual report of the Marine Group/CCG R&D activities.

The 1987/88 annual R&D report is published in support of our information dissemination and technology transfer policies. It is intended to communicate and share our knowledge and experience and to solicit comments/suggestions from the industry at large.

Volume I

Volume I of the report contains an overview of the results of the Coast Guard R&D program for 1987/88.

Section I of Volume I details the objectives and responsibilities of the Marine Group/CCG, and the individual R&D programs under which projects were carried out.

Section II provides highlights of achievements during FY 1987/88, and program expenditure summaries by funding sources and Key Result Areas (KRA'S)/Fleet Program Areas (as appropriate).

Section III indicates future goals. Appendices which include expenditure summaries for individual programs and detailed project information are published as a separate volume.

Section IV contains a list of reports which resulted from research projects conducted in 1987/88. Some of the reports may have a restricted distribution because of commercial confidentiality of the data, international agreements, etc. (The list of reports also appears as Appendix G in Volume II).

Volume II

Volume II of the report contains summaries of each project undertaken as part of the CCG R&D Program.

In addition it contains a list of reports which resulted from research projects undertaken in 1987/88. (The list also appears as Section IV of Volume I).

Deputy Minister

Assistant Deputy Minister
Marine
and Commissioner
Canadian Coast Guard

Deputy Commissioner
Canadian Coast Guard

Director General
Northwestland
Region

Director General
Maritimes
Region

Director General
Laurentian
Region

Director General
Central
Region

Director General
Western
Region

Director General
Fleet Systems

Director General
Aids & Waterways

Director General
Telecommunications
& Electronics

Director General
Ship Safety

Director General
Ports & Harbours

Director
Executive Services

Director
Resource Management

Director
Coast Guard
Northern

Director
Search & Rescue

Canartic
Shipping

Atlantic
Pilotage
Authority

Pacific
Pilotage
Authority

Laurentian
Pilotage
Authority

Great Lakes
Pilotage
Authority

9 Harbour
Commissions

Canada Ports
Corporation

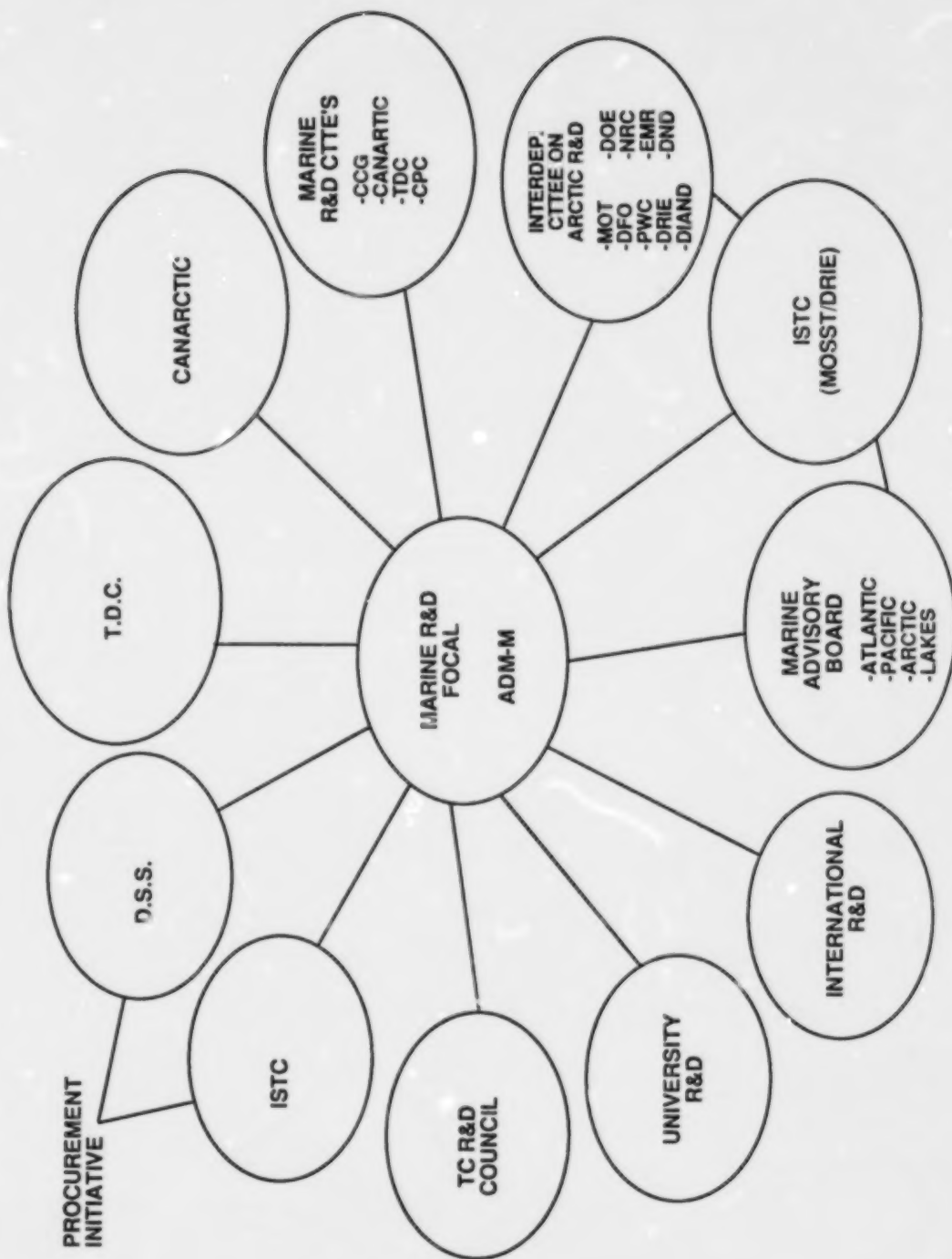
St. Lawrence
Seaway
Authority

Seaway International
Bridge
Corporation

Jacques Cartier &
Champlain Bridges
Inc.

Corporate
Departmental (Canadian Coast Guard)

R&D COORDINATION (MARINE)





SECTION I

TRANSPORT CANADA MARINE GROUP/CCG MISSION

To attend to the development and operation of a safe and efficient national (Marine) Transport System;

- by providing, or ensuring the provision of, services which facilitate the safe and efficient movement of vessels in Canadian waters;
- by developing an appropriate and timely regulatory base; and
- by cooperating with other public and private members of the marine community in order to ensure the safe and economical conduct of marine transportation.

MARINE R&D OBJECTIVES

To undertake R&D in support of Marine Group/CCG operational, regulatory, and procurement objectives.

To contribute to related federal objectives and provide the leadership necessary to ensure that marine transportation R&D activities are coordinated.

To promote and facilitate timely technological innovation in marine transportation and related (marine) industries, contributing to improved safety, efficiency and effectiveness in the marine transportation system.

To work with other federal research centres, provinces, universities and independent research agents to promote marine centres of excellence and to aid in the training of operating personnel, scientists and other professionals in marine matters.

PARTICIPATING COAST GUARD BRANCHES AND BRANCH R&D OBJECTIVES

Executive Services

To provide administrative and coordination services in R&D to other participating branches. To provide liaison with the marine community at large and with specific marine R&D performers.

Fleet Systems

To improve the operational efficiency of the CCG fleet by developing and examining new technology as well as by collecting data to evaluate operational effectiveness. To acquire and maintain an effective and efficient fleet.

Aids and Waterways

To ensure that utilization of Canadian waterways and way facilities is not detrimental to public safety, property, or the marine environment.

To increase accessibility of Canadian ice-covered waterways to marine traffic.

To foster increased efficiency of the aids operation by reducing operational and maintenance costs.

Ship Safety

To obtain necessary data for keeping ship safety regulations up-to-date with development in modern technology and for drafting new regulations as necessary.

Telecommunications And Electronics

To assess the suitability of available telecommunications, electronics, computer and space technology to meet Coast Guard operational and regulatory requirements and those of the marine community.

To assess newly developed systems or equipment, to accomplish necessary pre-engineering, and to monitor and support fundamental technological investigations in electronic circuitry performed by the scientific community and by industry.

Emergencies

To improve operational efficiency through the field evaluation of newly developed counter-measures techniques that have not been assessed by other government agencies.

Northern

To obtain necessary data specific to arctic ships' operating conditions for arctic-class ships, in order to keep ship safety regulations up to date. To propose new regulations for developing arctic technologies.

To continue polar icebreaker R&D related to ship design, its subsystems and basing requirements.

Search and Rescue

To improve marine operational efficiency in search and rescue activity through the field evaluation of newly developed equipment.

INTERNAL CCG FUNDING SOURCES

Arctic Waters Regulatory Studies Program (AWRSP)

This program was set up in 1986/87 due to the cancellation of the Arctic Marine Transportation R&D Program (AMTRD). The main program objective is to update the Arctic Waters Pollution Prevention Act. Therefore, priority is given to projects addressing regulatory and safety concerns in the Canadian Arctic. Project details under Appendix A.

Fleet Capital Investment Plan (FCIP) R&D

Treasury Board approval for the R&D component of FCIP was obtained in 1985/86; the program commenced in 1986/87. This component is defined as any investigatory, analytical or developmental activity, whether associated with equipment, systems, or personnel that is designated to improve the efficiency or effectiveness of the Fleet Mission. Project details under Appendix B.

Regulatory and Engineering Studies (RD&ES) Plan

The RD&ES Plan was established in 1982/83 to fund feasibility and engineering studies, field service surveys or other such types of applied R&D related projects. Project details under Appendix C.

Energy R&D Program (ER&D)

The federal Energy Research and Development Program began in 1975/76 under the administration of the Department of Energy, Mines and Resources (Office of Energy R&D). It was reorganized during 1981/82 in response to the priority set under the National Energy Program (NEP). It is now categorized into tasks as follows:

- 1) Conservation;
- 2) Oil Sands/Heavy Oil and Gas;
- 3) Nuclear Energy;
- 4) Renewable Energy;
- 5) New Liquid Fuels; and
- 6) Conventional Energy Resources.

In the marine mode sub-program, the principle ER&D activities have historically been concerned with the transport of energy commodities, in particular with the transport of oil and gas from the Arctic and offshore regions. As a result, the Conventional Energy Resources (Task 6) is the most frequent source of funds for the Marine Group/CCG.

The Energy Conservation (Task 1), the Renewable Energy (Task 4) and New Liquid Fuels (Task 5) Programs are also potential sources of funds for Marine Group components. Project details under Appendix D.

DSS Unsolicited Proposals (UPs) Program

The Department of Supply and Services operates an industrial incentive program whereby private companies may submit unsolicited research and development project proposals via DSS (known as formal unsolicited proposals) for government consideration. The CCG has been an active participant since 1978.

Proposals supported by the Marine Group are financed from the CCG internal R&D programs. Proposals funded or sponsored in 1987/88 are listed in Appendix E.

Transport Development Center (TDC) "A" Base R&D Program

The mission of the Transportation Development Centre (TDC) is to provide components of Transport Canada with specific data, research and demonstration projects to assist components in their operational, regulatory, policy, planning and evaluation functions, and to undertake exploratory R&D addressing requirements in transportation technology and systems that are high risk, long range and national in scope.

Marine Group components may participate jointly with TDC in the management of R&D projects or may ask TDC to undertake projects on their behalf. Projects undertaken jointly with TDC are included under Appendix A and B.

Other Departments

Every year there are some projects which are jointly funded by several departments. Either Coast Guard supports a project initiated by other departments or we get support for our projects. This occurs when the project results are of direct or indirect benefit to a number of government departments or agencies. Projects are included under Appendix B and C.

SECTION II

1987/88 PROGRAM HIGHLIGHTS

Arctic Waters Regulatory Studies Program (AWRSP)

In 1987/88 the work of the Sub-committees set up to provide industry input to the update of the Canadian Arctic Shipping Pollution Prevention Regulations (CASPPRS) continued. These sub-committees play a major role in the regulatory review process. We believe that their contribution will assist Coast Guard in the smooth introduction of CASPPR revisions.

The research projects undertaken under AWRSP are intended to provide input to the regulatory review process. Major thrust of the 1987/88 program included work on the behaviour of ice in the crushed ice zone to increase the understanding of ship/ice, structure/ice interaction; work on ice regime studies to assist in defining zones and entry dates; and an investigation of steering system and rudder arrangement design criteria. In addition, research projects related to Arctic lifesaving and survival were undertaken.

Fleet Capital Investment Plan (FCIP) R&D

In 1987/88 work began on an HF Air/Ship Position Exchange Communication System which, if successful, will provide a simple low cost position information exchange system.

A feasibility study for applying ultrasonic testing to monitor pipe system degradation was begun in 1987/88. If feasible, the technology will provide a quick and non-destructive method of locating problem areas and scheduling repairs to minimize operational impacts.

The design phase of the Arktos Beta, an arctic utility and emergency vehicle was completed and construction of the vehicle is now well underway.

The work on the Launch/Recovery System for Rigid Hull Inflatables, begun in 1986/87, was completed and a re-designed Miranda Davit was developed for CCG operations.

CCG also participated in a major project to develop and evaluate a hardware and software system to integrate various ships' navigational sensors.

Research & Development and Engineering Studies Plan (RD&ES)

Numerous projects intended to improve the safety, efficiency and effectiveness of marine transportation were undertaken under the plan.

Among the subject areas investigated were various means to improve the efficiency of the marine aids operation by reducing equipment maintenance and servicing requirements and improving equipment reliability; and studies to assist in the understanding of fishing vessel stability and MODU stability.

The design of the Coast Guard "Oil Harvester" was also improved and performance trials with the prototype exceeded expectations.

Program for Energy Research and Development

1987/88 saw the completion of Phase V of the Shipboard Ice Navigation Support System (SINSS). Phase V covered the implementation and operational assessment of a first generation SINSS.

An historical analysis of MV Arctic Vessel performance and trafficability data for the years 1983-87 was also completed in 1987/88.

SECTION III

Future Goals

The Coast Guard research program constitutes a major expenditure in marine transportation research. Its impact extends beyond the immediate objectives of this federal agency. The results are of value to scientists, industry and universities.

A major objective of the CCG is to improve the flow of information on its research results to the marine community at large. This involves the development of policies for the control of sensitive information and the promotion of a more focussed information dissemination (or technology transfer) procedure.

In 1987/88 a major effort to improve the CCG R&D planning process was initiated. This exercise will continue into 1988/89. A longer-term horizon on the operating environment and a five-year specification of direction would assist in promoting continuity in research interests in the face of fluctuating resources.

Also, to improve the planning of federal operational and regulatory research, it is important to improve on our communication linkages with industry and the science community. National mechanisms such as the ADVISORY BOARD ON MARINE TRANSPORTATION R&D, and the National Research Council will continue to play a major role in the review of the CCG R&D program.

The effective solicitation of technologies or knowledge from other countries can also be aided through a well-structured program of international cooperation. The involvement of Canadian industries, consulting firms or universities as performers of the Canadian-side of international research will assist the in-flow of technology and foster joint-venture projects.

A major operational challenge of the future continues to be the design and procurement of the POLAR 8 icebreaker.

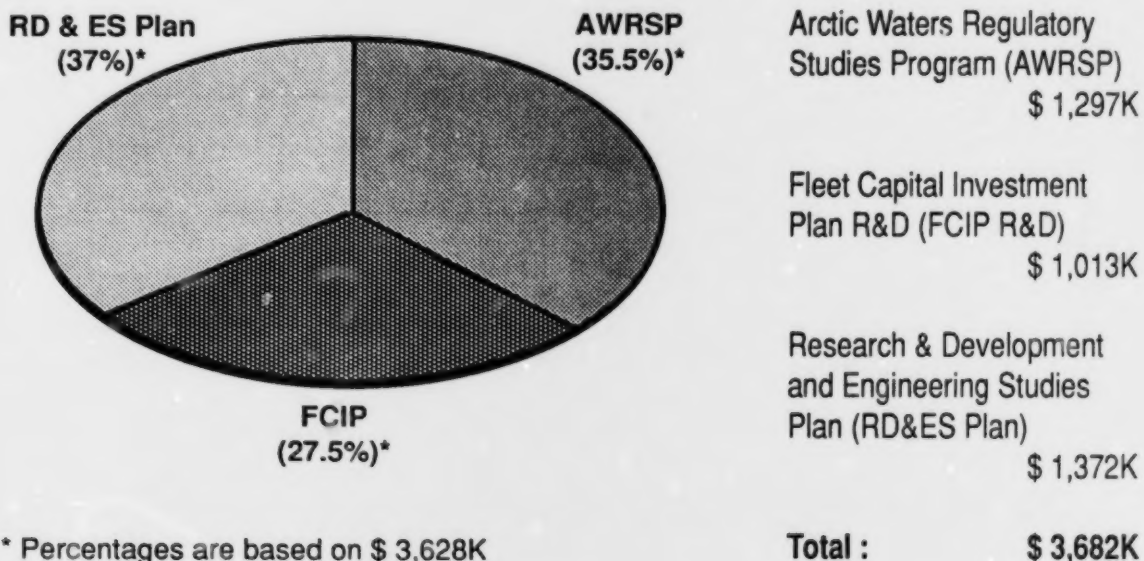
COG 1987/88 R&D SUMMARY

BY FUNDING SOURCE

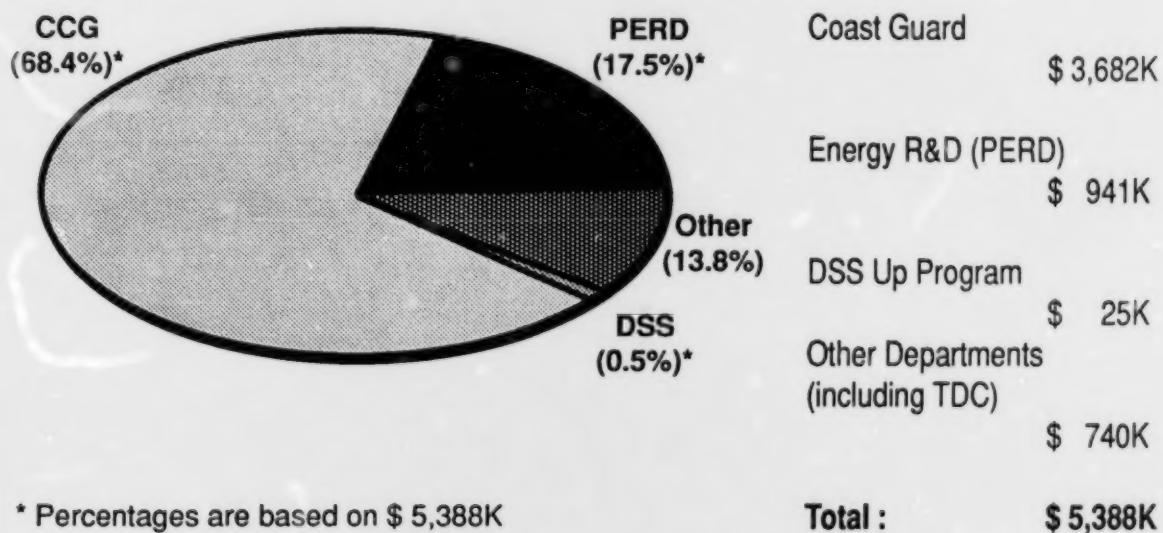
Funding Source	1987/88 \$' 000
Internal COG Funding Sources	
Research & Development and Engineering Studies (RD&ES) Plan	1,372
Fleet Capital Investment Plan R&D (FCIP R&D)	1,013
Arctic Waters Regulatory Studies Program (AWRSP)	<u>1,297</u>
TOTAL INTERNAL	3,682
External Funding Sources	
Energy R&D	941
DSS Unsolicited Proposals (UP's) Program	25
Other Departments (including TDC)	<u>740</u>
TOTAL EXTERNAL	1,706
TOTAL	5,388

CCG 1987/88 R&D Program Summary by Funding Source

Internal Funding Sources



Total Funding (Internal and External)



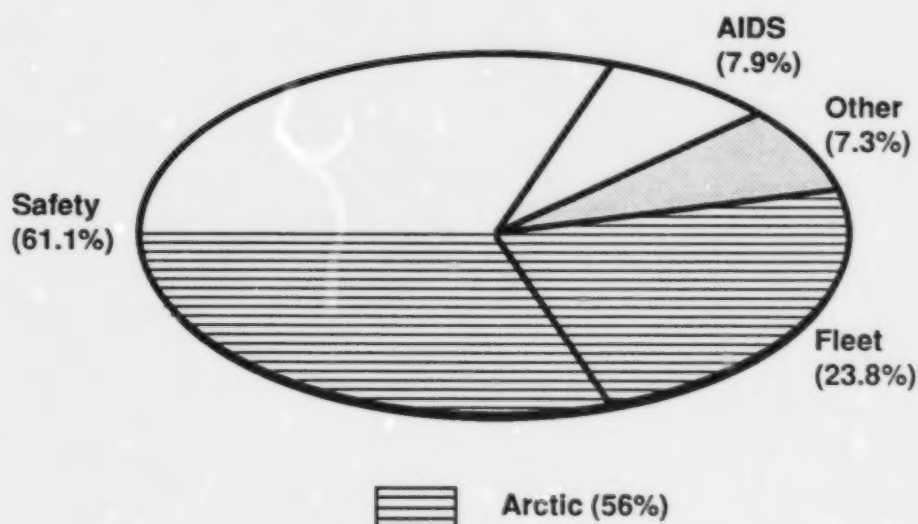
1987/88 COG R&D PROGRAM BY KEY RESULT AREA/FLEET PROGRAM AREA AND SOURCE OF FUNDS

	KRA/FLEET PROGRAM AREA	RD&ES 000' s	FCIP 000' s	AMRSP 000' s	PERD 000' s	DSS UP 000' s	Other * 000' s	TOTAL
SAFETY	SHORT RANGE AIDS TO NAVIGATION (SRAN)	429						429
	SAFETY & PUBLIC CORRESPONDENCE COMMUNICATIONS (SPCC)	200						200
	VESSEL TRAFFIC SERVICES (VTS)	43						43
	WATERWAYS DEVELOPMENT MAINTENANCE & PROTECTION (WMMP)	8						8
	SHIP SAFETY (SS)	348					345	693
ARCTIC	SEARCH & RESCUE OPERATIONS (SARO)	232						232
	EMERGENCIES (EMG)	97						97
	DIRECTION & ADMINISTRATION (D&A)	15						15
	ARCTIC R&D (AR&D)							
	SAFETY & REGULATORY			1,297	941		140	2,378
OPERATIONS	FLEET: SHIPS		965** 48			25	255	1,245 48
	FLEET: AVIATION							
	TOTAL	1,372	1,013	1,297	941	25	740	5,388

* TDC "A" Base (\$275K); DOE (\$160K); COGLA (\$15K); EMR (\$65K); U.S.A. (\$70K);
NRC (\$105K); OTHER (\$50K).

** 624K of this amount is related to arctic research.

Summary of the 1987/88 Research & Development Program by Key Result Areas (KRA's)/Fleet Program Areas



Safety - includes R&D related to Ship Safety , Safety and Public Correspondence Communications and Arctic Safety and Regulations (\$ 3271K).

Aids To Navigation - includes R&D related to Short Range Aids to Navigation (\$ 429K).

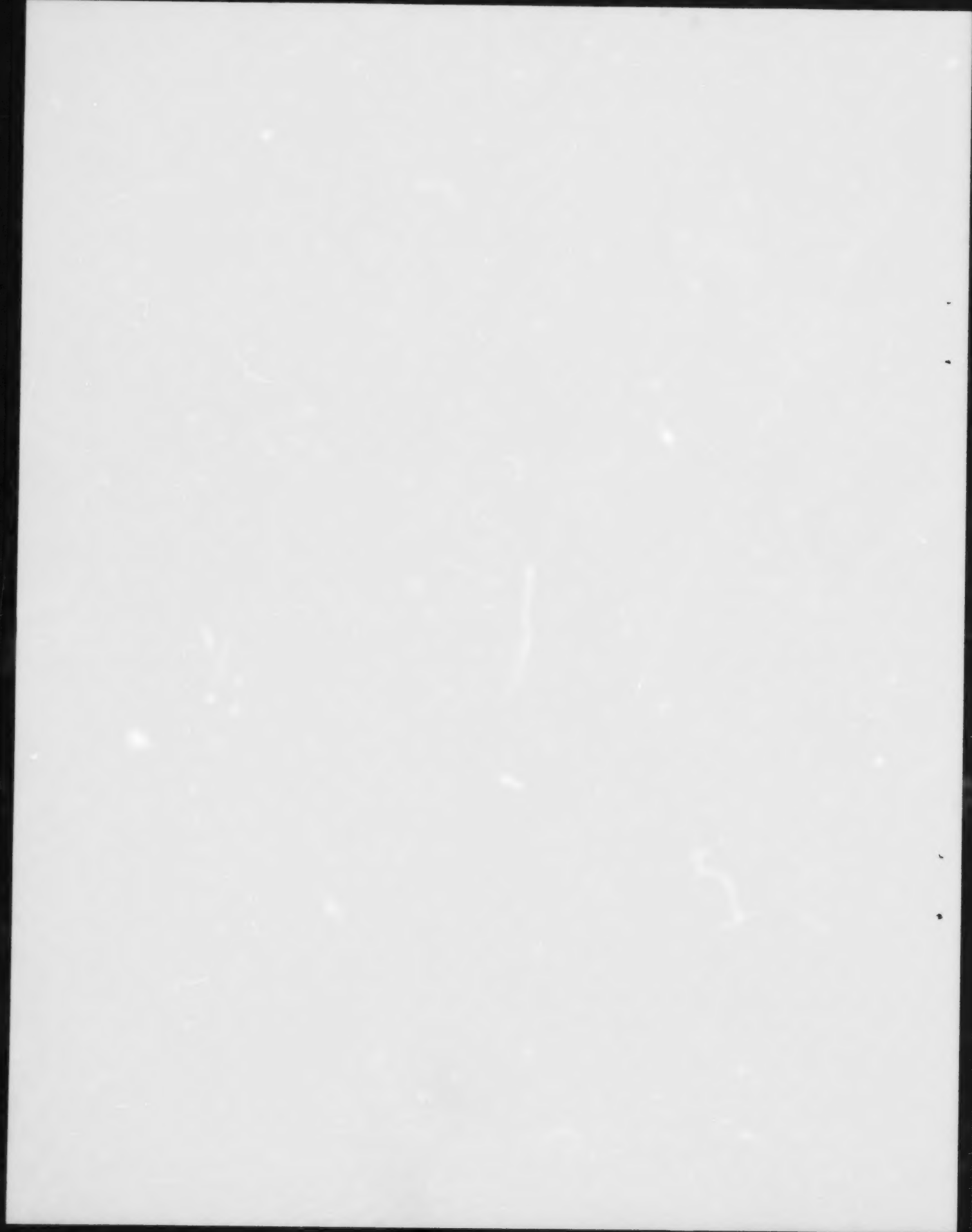
Fleet Operations - includes R&D which specifically addresses the requirements of Fleet Systems Branch related to either ships or aviation (\$ 1293K).

Other - includes R&D related to Emergencies, Search and Rescue Operations, Waterways Development, Maintenance and Protection, Vessel Traffic Services and Direction and Administration (\$ 395K).

Arctic - overlaps the headings above and includes (\$ 2378K) mainly Arctic Safety and Regulatory Research and the Arctic portion of Fleet Operations (\$ 624K) (Total \$ 3002K).

SECTION IV

List of Reports



List of Reports:

Project Number

AWRSP:

- 2071 TP 9157 - Strength and Stability of Framing for Ice Strengthening, Fleet Technology Ltd., March 1988.
- 2074 TP 8680E - Analysis of Ice Penetration Data in Support of Parametric Physical Modelling.
- TP 7976E - Continuation of Parametric Model Study of MV Arctic Hydroelectric Response During Multi-Year Ice Impacts.
- 2082 Ice Failure by Impact and Indentation - A Literature Review, Ian Jordaan and Associates (Report prepared for National Research Council), February 1988.
- 2083 TP 8890E - Arctic Shipping Pollution Prevention Regulations, Ice Regime Project, Case Studies of the Ice Numeral Concept, Polar Sea Research/Norland Science and Eng. Ltd., November 1987.
- Ice Regime Field Project Eureka and Bent Horn voyages, 1987. Vol. 1 - Shipboard Observations, Eureka Voyage. Vol. 2 - Shipboard Observations, Bent Horn Voyage. Vol. 3 - Data report; Polar Sea Research/Norland Science and Eng. Ltd., March 1988. (Draft only)
- Evaluation of the Effects of Ice Regime Qualifiers on Ship Entry Decisions, Norland Science and Engineering Ltd./ Polar Sea Research Ltd., April 1988.
- 2084 TP 9158 - Arctic Survival Equipment Tests 1987/88, Melville Shipping Co. Ltd., March 1988.
- TP 8825 - Ship Evacuation Trials in Ice Covered Waters.
- 2085 A Ship Abandonment Survival Guide for Arctic Mariners (Chapter 1-3), Melville Shipping Co. Ltd., March 1988.
- 2086 Update of the Arctic SAR Database, Fleet Technology Ltd., April 1988. (Draft)
- 2090 See listing for Energy R&D project 2194 B.
- 2091 TP 8952 - Assessment of Trafficability and Vessel Manoeuvring and Structural Performance in a Mixed Old Ice Regime, Canarctic Shipping Co. Ltd., March 1988.
- 2447 TP 9026 - Feasibility Study on an Applied Research Program into Steering Gear and Rudder Design Criteria for Commercial Arctic Vessels. Vol. 1 - Final Report, Vol. 2 - Appendices (Appendices are protected), Canarctic Shipping Co. Ltd., March 1988.

List of Reports

Project Number

FCIP

- 2920 TP 8269E/F - Evaluation of the Performance of a Modern Commercial Icebreaker, Vol. I & II, February 1987.
- 2982 "Miranda" Davit Launch/Recovery System for Rigid Hull Inflatable (RHI) Boats, The Cord Group Limited, March 1988

ROGES

- 2122 A Study of Equipment and Techniques to Dispose of Oily Materials from Spill Cleanup, S.L. Ross Environmental Research Ltd.
- 2126 System Manual for LORAN-C Data Acquisition System, July 1987.
- 2132 Evaluation of Ship Location and Reporting System, July 1988.
- 2141 Engineering Studies Evaluation of the "Oil Harvester", DEW Engineering and Development Limited, March 1987.
- 2149 TP 8325E - Mathematical Model of Sediment Transport in Sinuous Rivers, Western Canada Hydraulics Laboratory Limited
- 2161 Interim Report on Phase I (theoretical calculations).
- 2162 Interim Report on the Theoretical Calculation of Visual Ranges, March 1987.
- Final Report, March 1988.
- 2163 Prototype Buoy Cleaning and Painting Equipment, Final Report, December 1987.
- 2268 Report on Coast Guard buoy cleaning and painting facilities at the Bases used for test paint applications
- 2281 Offshore Testing of Booms and Skimmers, S.L. Ross Environmental Research Limited.

List of Reports

Project Number

- 2321 TP 8937E - Test and Evaluation: "Seabeacon" Mark III, Vol. 1 and 2.
- 2422 TP 7935 - Field Collection Data, September, 1986, Ocean Chem Limited
- 2444 Report on NAVTEX Research and Development Project.
- 2446 System Manual Documentation Applicable to Killinek and Harrington Harbour, April 1988.

Energy R&D (PERD)

- 2194A TP 9215E - Phase V Final Report - Shipboard Ice Navigation Support System, Canarctic Shipping Co. Ltd., March 1988.
- 2194B TP 9063E - Seasonal and Historical Analysis of the MV Arctic Vessel Performance and Trafficability Data Base, 1983-87 (Vol. 1). Vessel Performance and Trafficability Study for the MV Arctic 1987 Trading Season (Vol. 2), Canarctic Shipping Co. Ltd., Norland Science and Engineering Ltd., March 1988.
- 2082 Ice Crushing by Impact and Indentation, a Literature Review, Ian Jordaan and Associates, Inc., February 1988. (Also listed under AWRSP project 2074).
- 2238-1 Phase I, Milestone Report #2, Year-Round Accessibility of the Beaufort Sea from the East via the Southern route of the Northwest Passage.
- 2238-2 Phase I, Milestone Report #2, Eastern Parry Channel Winter Ice Regime Study, Phase I.

Volume

2



Canadian
Coast Guard

Garde côtière
canadienne

TP9172E

Canadian Coast Guard
Research and Development

Annual Report

1987 / 88



Vol. 2 Program Detail

Canada



Canadian
Coast Guard

Garde côtière
canadienne

R&D PROJECT REPORT DOCUMENTATION FORM

1. Transport Canada Report No. TP 9172 E/F - Vol. II	2. CCG Project No.	3. Recipient's Catalogue No.	
4. Title and Subtitle Canadian Coast Guard Research and Development ANNUAL REPORT 1987/88 - Vol. II		5. Report Date November, 1988	6. Performing Organization Report No.
		8. Transport Canada File No.	
7. Author(s)		10. DSS File No.	11. DSS or Transport Canada Contract No.
9. Performing Organization Name and Address CCG		13. Type of Report and Period Covered	
		14. Sponsoring Agency Code	
15. Supplementary Notes		16. CCG Project Officer	
17. Abstract Annual Report on 1987/88 CCG R&D Activities Vol. II - Detailed Project Descriptions			
18. Key Words Marine Research and Development, CCG Research Program, Arctic Marine Research, Procurement Related Research, AWRSP, FCIP, RD&ES, PERD, UP,s		19. Distribution Statement	
20. Security Classification (of this report) Unclassified	21. Security Classification (of this page)	22. No. of Pages	23. Price



Garde côtière
canadienne

Canadian
Coast Guard

FORMULE DE DOCUMENTATION POUR RAPPORT DU PROJET (R&D)

1. N° du rapport Transports Canada TP 9172 E/F Vol. II	2. N° de l'étude de GCC	3. N° de catalogue du destinataire
4. Titre et sous-titre Recherche et Développement de la Garde côtière canadienne Rapport annuel de 1987/88	5. Date du rapport novembre 1988	6. N° du rapport de l'organisme exécutant
	8. N° de dossier Transports Canada	
7. Auteur(s)	9. Nom et adresse de l'organisme exécutant	10. N° de dossier - ASC
		11. N° de contrat - ASC ou Transports Canada
12. Nom et adresse de l'organisme parrain GCC	13. Genre de rapport et période visée	
	14. Code de l'organisme parrain	
15. Remarques additionnelles	16. Agent de projet de GCC	

17. Résumé

Recherche et Développement de la Garde côtière canadienne
Rapport annuel de 1987/88

Vol. II - Détails sur le programme

18. Mots-clés Recherche et Développement dans le domaine maritime, Programme de recherche de la GCC, Recherche Maritime dans l'Arctique, Recherche concernant les achats, PEREA, PICF, Plan de RD&ET, PERD, PS	19. Diffusion		
20. Classification de sécurité (de ce rapport)	21. Classification de sécurité (de cette page)	22. Nombre de pages	23. Prix

CANADIAN COAST GUARD
RESEARCH & DEVELOPMENT

ANNUAL REPORT

1987-88

(Vol. II)

CONTENTS

VOLUME II

Appendix A

Arctic Waters Regulatory Studies Program (AWRSP)	2
List of Projects	
Key Result Area: Arctic R&D - Safety & Regulatory	5

Appendix B

Fleet Capital Investment Plan (FCIP)	
R&D by KRA/Fleet Program Area	23
List of Projects	
KRA/Fleet Program Area: B.1 Fleet: Aviation	25
B.2 Fleet: Ships	27

Appendix C

Research & Development and Engineering	
Studies (RD&ES) Plan by Key Result Area	44
List of Projects	
C.1 Short Range Aids to Navigation	48
C.2 Ship Safety	72
C.3 Safety & Public Correspondence Communication	86
C.4 Vessel Traffic Services	93
C.5 Emergencies	98
C.6 Waterways Development, Maintenance & Protection	104
C.7 Search & Rescue Operations	107
C.8 Direction and Administration	112

Appendix D

Program Energy R&D (PERD)	115
List of Projects	117
Key Result Area: Arctic R&D, Safety & Regulatory	

Appendix E

Unsolicited Proposals	123
List of Projects	

Appendix F

R&D Management Publications	127
-----------------------------	-----

Appendix G

List of Reports	129
-----------------	-----

Volume II

VOLUME II contains summaries of each project undertaken as part of the CCG R&D Program. In addition it contains a list of reports which resulted from research projects undertaken in 1987/88. Some of the reports may have a restricted distribution because of commercial confidentiality of the data, international agreements, etc. (The list of reports also appears as Section IV of Volume I).

APPENDIX A

Arctic Waters Regulatory Studies Program
(AWRSP)

Arctic Research and Development

APPENDIX A

1987/88 AWRSP BY KEY RESULT AREA
(KRA) AND SOURCE OF FUNDS

KRA	AWRSP 000's	TDC 000's	OTHER* 000's	TOTAL
Arctic R&D: Safety & Regulatory	1,297	35	545	1,877

* Other is \$100K from FCIP on Ice Reconnaissance Round Robin, \$105 from NRC for Ice Crushing Project, \$40K from PERD for Ice Crushing Project, and \$300K from OERD for Ice Regimes Project.

ARCTIC WATERS REGULATORY STUDIES PROGRAM (AMN)

PROJECT LIST

Project #	Project Title	1987/88 Expenditures 000's
2071	Further Regulatory Revision	190
2074	Parametric Study of Hull Girder Ice Loads	155
2082	Investigation of Ice Failure Criteria	237 ¹
2083	Define Zones and Entry Dates	136
-1	- ASPPR - Ice Regime Field Project Eureka Voyage 1987	
-2	- Definitions of Zones and Entry Dates from Considerations of the Ice Regime	
2084	On Ice Survival Equipment Trials	254 ²
-1	- Ship Evacuation Trials in Ice Covered Waters Using Lifeboats and Life-rafts	
-2	- On Ice Survival Tests in Arctic 1987/88	
-3	- Arctic Survival Sled	
-4	- Sea Ice Syn. Apert. Radar Signature Analysis Interpretation Manual	
2085	Development of a Ship Abandonment Survival Guide for Arctic Conditions	27
2086	Arctic Search and Rescue (SAR) Requirements	26
2090	Ice Regime Study	360
2091	Support of Special Voyage Requirements	133
2447	Investigation of Regulatory Requirements for the Strength of Rudders Stocks	59
2517	Ice Reconnaissance Round Robin using Synthetic Aperture Radar (joint project with FCIP #2517)	300 ³
TOTAL		1,877*

1. \$92K - AWRSP
\$105K - NRC
\$40K - OERD

2. \$219K - COG/AWRSP
\$35K - TDC

3. \$200K - COG/AWRSP
\$100K - COG/FCIP

* Total AWRSP funding is \$1,297K.

Project Number: 2071/2081

Key Result Area: Arctic Research & Development

Project Title: Further Regulatory Revision

Project Officer: Mr. V.M. Santos Pedro, Coast Guard Northern,
Ottawa, 991-6003

Contractor/Performer: Fleet Technology Limited (Arctec)
University of Victoria

Financial Schedule:	<u>Previous</u> <u>Years</u>	<u>87/88</u> <u> </u>	<u>Future</u> <u>Years</u>	<u>TEC</u> <u> </u>
	-	190	-	190
				<u>190</u>

In conjunction with Project #2081 - Delineation of
Hull Areas.

Project Description: To establish a procedure for the development, discussion and promulgation of regulations which ensures input from industry and other related agencies and responds in a timely fashion to the requirements of new technologies.

To establish a mechanism for regular dialogue between the government and the industry on regulatory matters affecting the waters North of 60° N.

To develop, validate and implement a set of criteria and analytical procedures and methods to evaluate the impact of proposed regulations on the industries involved in the North, other organizations with interest in Arctic navigation and government departments.

Status: Work is continuing with completion targetted for 1988/89. The draft proposal revision to ASPPR is 85% complete.

Reports/Deliverables: TP 9157 Strength and Stability of Framing for Ice Strengthening, Fleet Technology Ltd., March 1988.

**Industrial/Scientific/
Technical Opportunity:** Industrial input to regulatory amendments.

Project Number: 2074

Key Result Area: Arctic Research & Development

Project Title: Parametric Study of Hull Girder Ice Loads

Project Officer: Mr. J.S. McCallum, Coast Guard Northern,
Ottawa, 991-6001

Contractor/Performer: Fleet Technology Ltd. (Arctec)

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
COG	101*	155	-	256
(PERD)	551*	-	-	<u>551</u>
				807*

This project is a continuation of work under project #2225, funded by AWRSP.

Project Description: The 1987/88 portion of the work included the following tasks:

- 1) Examination and analysis of Kigoriak full scale data with a view to construction of a model.
- 2) Further examination of 1986 model test data in light of discussions under the Canada/Finland Joint Research project arrangement.
- 3) Controlled laboratory penetration tests into model ice. Results to be compared with available full scale force/indentation and pressure/area results.

Status: Technical difficulties arose in Tasks 2 and 5 which lead to the possibility of the project exceeding the contract value.

Reports/Deliverables: TP 8680E - Analysis of Ice Penetration Data in Support of Parametric Physical Modelling.

TP 7976E - Continuation of Parametric Model Study of MV Arctic Hydroelastic Response During Multi-Year Ice Impacts.

**Industrial/Scientific/
Technical Opportunity:** The project will result in a major advance in ship/ice interaction dynamics and a major advance in dynamic modelling of ships generally. The technology can be applied to the study of wave loads.

Project Number: 2082

Key Result Area: Arctic Research and Development

Project Title: Investigation of Ice Failure Criteria

Project Officer: Mr. J.S. McCallum, Coast Guard Northern,
Ottawa, 991-6001

Contractor/Performer: Institute for Research in Construction - NRC

Financial Schedule:	<u>Previous</u>	<u>87/88</u>	<u>Future</u>	<u>TEC</u>
	<u>Years</u>		<u>Years</u>	
COG	-	92	50	142
PERD	-	40	130	170
NRC	-	105	300	<u>405</u>
				717

Project Description: To investigate the mechanism involved in the ice crushing part of the process of structure/ice or ship/ice interaction during impact in order to better understand and more accurately quantify the associated forces. Since ice behaviour has been described only in a very general sense, particular effort will be put into quantitative measurements of the whole impact process with an emphasis on the behaviour of the crushed ice zone in this proposed study.

Status: Work continuing under Letter of Agreement.

Reports/Deliverables: Progress Reports
Ice Failure by Impact and Indentation - A Literature Review, Ian Jordaan and Associates (Report prepared for National Research Council), February 1988.

**Industrial/Scientific/
Technical Opportunity:** Literature review provides a useful compendium of the literature on ice crushing by impact and indentation. Also helpful suggestions in relation to experimental and theoretical work.

Project Number: 2083

Key Result Area: Icebreaking and Northern Operations

Project Title: Define Zones and Entry Dates

Project Officer: Mr. J.S. McCallum, Coast Guard Northern,
Ottawa, 991-6001

Contractor/Performer: Polar Sea Research/Norland Science and Eng. Ltd.

Financial Schedule:

<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
-	136	-	136
			<u>136</u>

Project Description: To update the Arctic Shipping Pollution Prevention Regulations. If necessary, the procedure developed under any previous contract will be changed to test further ice type weighting proposals as to their validity for an Ice Numeral/Decision Numeral System governing ship entry to regimes. Other feasible ice regimes will be checked with respect to severity, as debate is going on between members of the sub-committee and others regarding the severity of ice regimes that each category might enter.

Status: Completed. Reports and video for regulatory update work used in finalizing proposed Ice Regime Ship Control System for Arctic.

Reports/Deliverables: TP 8890E - Arctic Shipping Pollution Prevention Regulations, Ice Regime Project Case Studies of the Ice Numeral Concept, Polar Sea Research/Norland Science Eng. Ltd., November 1987.

Ice Regime Field project Eureka and Bent Horn Voyages, 1987. Vol. 1 - Shipboard Observations, Eureka Voyage. Vol. 2 - Shipboard Observations, Bent Horn Voyage. Vol. 3 - Data report Polar Sea Research/-Norland Science and Eng. Ltd., March 1988. (Draft only)

Evaluation of the Effects of Ice Regime
Qualifies on Ship Entry Decisions, Norland
Science and Engineering Ltd.,/Polar Sea
Research Ltd., April 1988.

**Industrial/Scientific/
Technical Opportunity:**

The benefit of the system would be a more flexible and therefore more efficient control of Arctic shipping. The system will be made known to marine operators through the Transport Canada Regulatory System. The sub-committee is composed of government and industry representatives.

There is confidence that a satisfactory system will be found. Any risk lies in the fact that differences among the sub-committee members on the severity of ice regimes into which ships should have access may not be resolved.

Project Number: 2084

Key Result Area: Icebreaking and Northern Operations

Project Title: Arctic Survival Equipment Trials

Project Officer: M.B. Dempster, Coast Guard Northern,
Ottawa, 991-6006

Contractor/Performer: Melville Shipping Limited
Transportation Development Centre
DOE/F.G. Bercha and Associates

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
COG	-	219	-	219
TDC	-	35		<u>35</u>
				254

Project Description: The economic and relative suitability of lifesaving equipment, procedures and training will be examined to finalize requirements for Arctic lifesaving equipment. Full scale evaluation trials on equipment such as the ARKTOS will continue. A floatable sled will also be developed and tested suitable for the transportation of survival equipment across water and ice. A SEA ICE SAR interpretation manual will also be developed. The training and medical requirements for marine crew exposed to the risk of the Arctic Environment will be evaluated as well.

Status: The objectives of the projects have been carried out but there remains more to do on this subject. Many problems such as the disembarking of personnel from the liferafts and lifeboats alongside an iceflow remain to be further explored. Furthermore, there still remains more to do with more emphasis on the make-up of the rations packs, improvement of stoves, development of a safe heat source, improvement of foot wear and a further look at cooking utensils. Arctic Survival Sled is on-going to approx. August, 1988.

Reports/Deliverables: TP 9158 - Arctic Survival Equipment Tests, 1987/88,
Melville Shipping Co. Ltd., March 1988.

TP 8825 - Ship Evaluation Trials in Ice Covered
Waters.

**Industrial/Scientific/
Technical Opportunity:** Results will be of value to all companies operating
in the Arctic. Suppliers and manufacturers of
lifesaving and survival equipment may benefit from
increased sales and development of new equipment.

Project Number: 2085

Key Result Area: Arctic Research & Development

Project Title: Development of a Ship Abandonment Survival Guide for Arctic Conditions

Project Officer: M.B. Dempster, Coast Guard Northern,
Ottawa, 991-6006

Contractor/Performer: Melville Shipping Co. Ltd.

Financial Schedule:	<u>Previous</u> <u>Years</u>	<u>87/88</u> <u> </u>	<u>Future</u> <u>Years</u>	<u>TEC</u> <u> </u>
	-	27	25	52
				<u>52</u>

Project Description: The cold environment, ice conditions, and the remoteness of the Arctic shipping routes from search and rescue capabilities engender a requirement for self sufficiency beyond that required in other waters. There are presently no specific survival training or medical requirements for the crew on vessels operating in the Arctic. This area shall be examined to determine if such requirements are necessary. The purpose of the project is to develop a clear and concise manual for Canadian seafarers on how to survive in the Arctic if shipwrecked. From this manual a booklet will be further developed for issue to the individual seafarer.

Status: Chapters 1-3 have been completed as contracted. A decision will be made on whether to proceed with the rest of the guide.

Reports/Deliverables: A Ship Abandonment Survival Guide for Arctic Mariners (Chapter 1-3), Melville Shipping Co. Ltd., March 1988.

Industrial/Scientific/Technical Opportunity: Results will be of value to all companies operating in the Arctic. Suppliers and manufacturers of lifesaving and survival equipment may benefit from increased sales and development of new equipment.

Project Number: 2086

Key Result Area: Arctic Research & Development

Project Title: Arctic Search and Rescue (SAR) Requirements

Project Officer: M.B. Dempster, Coast Guard Northern,
Ottawa, 991-6006

Contractor/Performer: Fleet Technology Ltd. (Arctec)

Financial Schedule:	<u>Previous</u> <u>Years</u>	<u>87/88</u> <u> </u>	<u>Future</u> <u>Years</u>	<u>TEC</u> <u> </u>
	-	26	40	66
				<u>66</u>

Project Description: To evaluate requirements for SAR equipment necessary in the Arctic, and the suitability of existing equipment in low temperatures. The cold environment, ice conditions, and the remoteness of the Arctic Shipping routes from SAR capabilities engender a requirement for self sufficiency beyond that required in other waters. As there are presently no specific survival training or medical requirements for the crew on vessels operating in the Arctic, this area was examined to determine if such requirements are necessary.

Status: Draft report completed.

Reports/Deliverables: Update of the Arctic SAR Database, Fleet Technology Ltd., April 1988. (Draft)

**Industrial/Scientific/
Technical Opportunity:** Results will be of value to all companies operating in the Arctic. Suppliers and manufacturers of lifesaving and survival equipment may benefit from increased sales and development of new equipment.

Project Number: 2090

Key Result Area: Arctic Research & Development

Project Title: Ice Regime Project

Project Officer: Mr. J.S. McCallum, Coast Guard Northern,
Ottawa, 991-6001

Contractor/Performer: Canarctic Shipping Co. Ltd.

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
CCG	-	60	-	60
OERD	928	300	400	<u>1,628</u>
				1,688

Project Description: The main objective of the proposal is to detail ship-board observation of ship operations in various ice regimes, to aid in updating CASPPR. The project also hopes to identify Arctic voyages on which useful data may be available. The data will be used in resolving issues of ice regime access for various ship categories.

Status: Funds transferred to AME for their project #2194 B.

Reports/Deliverables: See listing under Energy R&D Project 2194 B.

Industrial/Scientific/
Technical Opportunity: -

Project Number: 2091

Key Result Area: Arctic Research & Development

Project Title: Support of Special Voyage Requirements

Project Officer: Mr. J.S. McCallum, Coast Guard Northern,
Ottawa, 991-6001

Contractor/Performer: Canarctic Shipping Co. Ltd.

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	-	133	94	227
				<u>227</u>

Project Description: This project was directed at collecting and analyzing manoeuvring and structural performance data during the transit of the MV Arctic in a mixed old ice cover. The field data collection program included both on ice data collection (for ground truthing purposes) and Shipboard trafficability and statistical data collection.

Status: Completed. Final report pending.

Reports/Deliverables: TP 8952 - Assessment of Trafficability and Vessel Manoeuvring and Structural Performance in a Mixed Old Ice Regime, Canarctic Shipping Co. Ltd., March 1988.

Industrial/Scientific/
Technical Opportunity: Increased confidence in a ship's ability to navigate at specified times in specified areas.

Project Number: 2447

Key Result Area: Icebreaking and Northern Operations

Project Title: Investigation of Regulatory Requirements for the Strength of Rudder Stocks and Steering Gears

Project Officer: C.C. Norris, Coast Guard Northern, Ottawa, 991-6002

Contractor/Performer: Canarctic Shipping Co. Ltd.

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	-	59	-	59
				<u>59</u>

Project Description: The project objective is to determine steering system and rudder arrangement design criteria for Arctic Vessels including but not limited to:

1. design loads for rudder stocks
2. steering gear hydraulic pressure control system
3. control and alarm system
4. steering system design torque
5. rudder structure
6. rudder stock and pintle/gudgeon loads

The study is intended to provide information on regulatory requirements and the feasibility of retrofitting protection devices and developing an instrumentation package.

The design basis is to be determined from an analysis of available full scale data of rudder and ice interaction for Arctic vessels, supplemented by analytical modelling. A simple model is to be used to develop an understanding of the "worst case" loads and how they would vary major ship parameters.

Status: Cost and proposed schedule of dedicated trials presented. Design analysis and steering control systems are discussed with recommendations for regulatory amendments. Proposed modifications to MV Arctic's steering gear are presented in case of dedicated testing. The final report is pending. f

Reports/Deliverables: TP 9026 - Feasibility Study on an Applied Research Program into Steering Gear and Rudder Design Criteria for Commercial Arctic Vessels. Vol. 1 - Final Report Vol. 2 - Appendices (Appendices are protected), Canarctic Shipping Co. Ltd., March 1988.

Industrial/Scientific/Technical Opportunity: To increase knowledge for operators, designers and government with spin-offs to the industrial and scientific community.

Project Number: 2517

Key Result Area: Arctic Research and Development

Project Title: Ice Reconnaissance Round Robin using Synthetic Aperture Radar (joint project with FCIP #2517)

Project Officer: Mr. A.L. Hart, Coast Guard Northern, Ottawa, 991-6005

Contractor/Performer: Intera Technologies Ltd.
Canarctic Shipping Co. Ltd.

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
COG/AWRSP	-	200	-	200
COG/FCIP	-	100	-	<u>100</u>
				300

Project Description: The project will provide C.G. with exposure to the quality and quantity of SAR imagery to be expected once the INTERA operation comes on line. Potential problems and systems development relating to handling large quantities of SAR data, in hardcopy and softcopy format, will be addressed. Data will be used for training in ice interpretation as well as for forward planning of vessel deployment.

The information derived from this exercise will be used to meet the C.G. departmental objective to provide icebreaking assistance to commercial vessels and vessels of other government departments, which navigate in the Arctic in the summer, and in the St-Lawrence River, Gulf of St-Lawrence and other ice-infested waters of the East Coast of Canada, in the winter.

The objective is to trial the equipment proposed for use during ice reconnaissance patrols, in the Arctic in the summer, and in the Gulf, St-Lawrence River, and Great Lakes in the winter.

The subject contract will be for a one time "round robin" ice patrol, with the purpose of providing ice imagery over an area of 10,850 nautical "line" miles, with a radar swath width of 17km or 63km, depending upon the resolution desired. The contractor will use synthetic aperture radar to capture the required data.

Status:

-

Reports/Deliverables:

-

Industrial/Scientific/
Technical Opportunity:

Given that the contract will be directed to INTERA, all industrial benefits would accrue to that company. Already a world leader in high level surveillance techniques, this project will increase their knowledge and experience, thus increasing the marketability of their product to private sector companies, specifically those engaged in energy exploration in the Arctic.

APPENDIX B

**Fleet Capital Investment Plan
(FCIP)**

APPENDIX B

FCIP BY KEY RESULT AREA (KRA)/FLEET PROGRAM
AREA AND SOURCE OF FUNDS

KRA/FLEET PROGRAM AREA	FCIP 000's	TDC 000's	EMR 000's	DSS 000's	OTHER* 000's	TOTAL
Fleet: Ships	965	240	15	25	200	1,445
Fleet: Aviation	48	-	-	-	-	48
Total	1,013	240	15	25	200	1,493

* Other is funding from AWRSP on Ice Reconnaissance Round Robin.

FLEET CAPITAL INVESTMENT PLAN R&D
1987/88 PROGRAM SUMMARY BY PROJECT
AND KEY RESULT AREA/FLEET PROGRAM AREA

KRA/FLEET PROGRAM AREA	PROJECT #	PROJECT TITLE	1987/88 EXPENDITURES 000's
Fleet: Aviation	2508	HF Air/Ship Communication System	48
* Fleet: Ships	2517	Ice Reconnaissance Round Robin using Synthetic Aperture Radar	300 ¹
* Fleet: Ships	2920	Commercial Icebreaker Evaluation	59
Fleet: Ships	2925	Feasibility Study of Applying Ultra- sonic Testing to Monitor Pipe System Degradation	1
* Fleet: Ships	2928	Arctic Utility & Emergency Vehicle	448
Fleet: Ships	2952	Effect of Welding Process and Parameters on Weldability of Selected Primers	91 ²
* Fleet: Ships	2975	Weld Corrosion Assessment	17
Fleet: Ships	2982	4 R 18' RHI Launch/Recovery System	227
Fleet: Ships	2983	Shipboard Integrated Navigation and Display Systems (SINADS) (Reduced Visibility/Buoy Laying and Checking)	302 ³
TOTAL			1,493

1. \$100K - COG/FCIP
\$200K - COG/AWRSP
2. \$51K - COG/FCIP
\$15K - EMR
\$25K - DSS
3. \$62K - COG/FCIP
\$240K - TDC

* Projects noted are a primarily oriented to arctic research and application.
(Total amount \$624K).

APPENDIX B.1

Fleet Capital Investment Plan
(FCIP)

Fleet: Aviation

Project Number: 2508

Key Result Area: Fleet: Aviation
Fleet Program Area:

Project Title: HF Air/Ship Position Exchange Communication System

Project Officer: Mr. C.D. O'Halloran, Coast Guard Fleet Systems
Ottawa, 998-1617

Contractor/Performer: Skywave Electronics Ltd.

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	-	48	-	48
				<u>48</u>

Project Description: The work will be conducted by Skywave Electronics Ltd. of Kanata, Ontario. The proposal is to design, develop and test an HF Air/Ship Position Exchange Communications System (PXCS) to permit a helicopter and ship to exchange position data via an HF radio link over water at ranges of 60 to 80 miles. The PXCS System will utilize existing HF SSB transceivers, ground wave transmission to achieve the desired range, and error free data communications based on packet radio techniques. Production units will be available for order from Skywave at the completion of the program.

Status: Ongoing

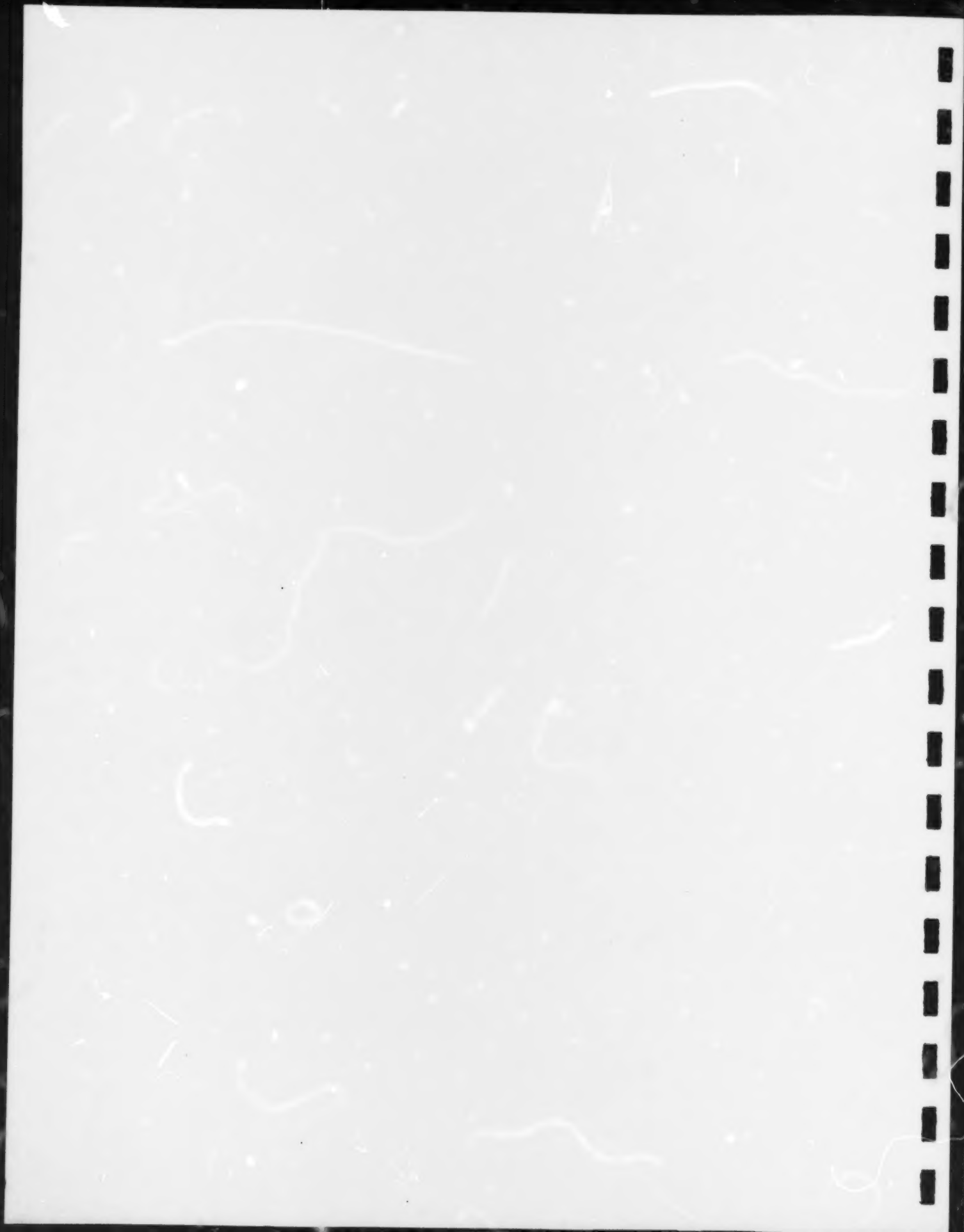
Reports/Deliverables: -

Industrial/Scientific/
Technical Opportunity: The successful development of this equipment should provide access to a world wide market wherever position information exchange is desirable between helicopters, aircraft and a base, be it on land or on board ship, etc. Successful completion of the project will result in Coast Guard gaining access to a simple low cost position information exchange system which will permit both ship and aircraft to be constantly aware of each other's position.

APPENDIX B.2

Fleet Capital Investment Plan
(FCIP)

Fleet: Ships



Project Number: 2517

Key Result Area: Fleet: Ships
Fleet Program Area:

Project Title: Ice Reconnaissance Round Robin using Synthetic Aperture Radar (joint project with AWRSP 2517)

Project Officer: Mr. A.L. Hart, Coast Guard Northern
Ottawa, 991-6005

Contractor/Performer: Intera Technologies Ltd.
Canarctic Shipping Co. Ltd.

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
FCIP	-	100	-	100
AWRSP	-	200	-	<u>200</u>
				300

Project Description: The project will provide C.G. with exposure to the quality and quantity of SAR imagery to be expected once the INTERA operation comes on line. Potential problems and systems development relating to handling large quantities of SAR data, in hardcopy and softcopy format, will be addressed. Data will be used for training in ice interpretation as well as for forward planning of vessel deployment.

The information derived from this exercise will be used to meet the C.G. departmental objective to provide icebreaking assistance to commercial vessels and vessels of other government departments, which navigate in the Arctic in the summer, and in the St-Lawrence River, Gulf of St-Lawrence and other ice-infested waters of the East Coast of Canada, in the winter.

The objective is to trial the equipment proposed for use during ice reconnaissance patrols, in the Arctic in the summer, and in the Gulf, St-Lawrence River and Great Lakes in the winter.

The subject contract will be for a one time "round robin" ice patrol, with the purpose of providing ice imagery over an area of 10,850 nautical "line" miles, with a radar swath width of 17km or 63km, depending upon the resolution desired. The contractor will use synthetic aperture radar to capture the required data.

Status: -

Reports/Deliverables: -

**Industrial/Scientific/
Technical Opportunity:** Given that the contract will be directed to INTERA, all industrial benefits would accrue to that company. Already a world leader in high level surveillance techniques, this project will increase their knowledge and experience, thus increasing the marketability of their product to private sector companies, specifically those engaged in energy exploration in the Arctic.

Project Number: 2920

Key Result Area: Fleet: Ships
Fleet Program Area:

Project Title: Evaluation of Commercial Icebreaker
(KALVIK) and Arctic Escape System

Project Officer: Captain D.H. Johns, Coast Guard Northern
Ottawa, 998-6574

Contractor/Performer: BeauDril Limited
Arctec Canada Limited
Watercraft Offshore Canada Limited

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
	1,478	59	-	1,537
				<u>1,537</u>

Project Description: Conduct performance evaluation trials on the commercial Class 4 Icebreaker MV KALVIK. Assess the vessel's performance in the role of a Coast Guard icebreaker including 'standard' performance trials (with controlled testing and data recording) and operational assessment by Coast Guard captains onboard for the evaluation.

Evaluate the general performance potential of Watercraft Offshore Canada Limited's prototype Arctic escape vehicle (ARKTOS) and if of sufficient potential, catalogue required modifications and testing in the 1987/88 period.

Status: All trials were carried out in September 1986 at Viscount Melville Sound.

The KALVIK was accompanied by the CCG Icebreaker JOHN A. MACDONALD, which acted as accommodation, helicopter support and "escorted" the vessel.

The trials have shown that the KALVIK is an excellent icebreaker in manoeuvres that involve continuous ahead icebreaking, and for the roles for which it was designed. The vessel having a higher power/size ratio than and other icebreaker examined, exhibits level icebreaking capability ahead that exceeds that of any other current Canadian icebreaker. However, the performance was less than adequate in other manoeuvres that involve turning and backing, which factor detracted from its ability to satisfy the requirement for the Coast Guard escort role. This deficiency is largely a function of the specific configuration of the KALVIK, driven by its somewhat limited role as an icebreaking supply/anchor handling vessel. A more conventional approach to the stern shape, more rounded lines along with a propulsion system configuration that provides greater response and turning thrust, may be more appropriate for a more multi purpose vessel.

While the above comments apply specifically to the KALVIK they are also applicable to the generic type of icebreaker operated in the Beaufort Sea, which have more limited mission profiles than Coast Guard vessels. As the number and variety of missions required increases, so the 'benefits' of design features which may improve efficiency in one or two specific operations become less obvious. Indeed in extreme cases, such features may have negative effects on other desired performance aspects. While a unique technology has been developed and evaluated in the Beaufort Sea operations, further development is required to prove its applicability to the design of a large vessel such as a Class 8 that will meet Coast Guard's many roles.

The evaluation of the Watercraft Escape System proved that the vehicle has great potential as a utility and support vehicle for Coast Guard Arctic operations.

Some modifications for Coast Guard requirements were presented to the company and a contract between Coast Guard and Watercraft was signed to develop a prototype (ARKTOS BETA) for fitting on the COGS Louis St. Laurent. The prototype is expected to be ready for trials in 1989.

Reports/Deliverables: TP 8269 E/F - Evaluation of the Performance of a Modern Commercial Icebreaker, Vol. I & II, February 1987.

**Industrial/Scientific/
Technical Opportunity:** To compare commercial icebreaker with traditional icebreaker designs in Coast Guard mission. Development of a new vehicle for the Arctic (Watercraft System).

Project Number: 2925

Key Result Area: Fleet: Ships
Fleet Program Area:

Project Title: Feasibility Study of Applying Ultrasonic Testing to Monitor Pipe System Degradation

Project Officer: Mr. L.D. Parkinson, Coast Guard Fleet Systems, Ottawa, 998-1777

Contractor/Performer: NDE - Quantum Inspection Services

Financial Schedule:	<u>Previous</u> <u>Years</u>	<u>87/88</u> <u> </u>	<u>Future</u> <u>Years</u>	<u>TEC</u> <u> </u>
	-	1	78	79
				<u>79</u>

Project Description: The project involves the implementation of a pilot project to assess the feasibility of applying ultrasonic test equipment to monitor the degradation of pipe wall thickness in piping systems. This would provide a quick and non-destructive method of locating problem areas and scheduling repairs to minimize operational impacts.

Status: The preliminary project approval has been delayed due to time needed for C.P.C. approvals. Difficulties were encountered in verifying location accessibility aboard the William Alexander due to lack of time vessel has been alongside.

Reports/Deliverables: Once all ultrasonic test data has been collected and analyzed, a final report will be generated by the project officer on the feasibility of applying ultrasonic thickness testing to piping systems on all extended voyage ice transiting vessels in the Fleet.

Industrial/Scientific/Technical Opportunity: This pilot project will lead to the formation of a report illustrating the feasibility of implementing ultrasonic thickness test methods to monitor pipe system degradation, and allow the transfer of this technology to other government agencies.

Project Number: 2928

Key Result Area: Fleet: Ships
Fleet Program Area:

Project Title: Arctic Utility and Emergency Vehicle

Project Officer: Mr. Victor Bennett, Coast Guard Fleet Systems,
Ottawa, 998-6849

Contractor/Performer: Watercraft Offshore Canada Ltd.

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
	-	448	1,611	2,059
				<u>2,059</u>

Project Description: Coast Guard has the responsibility for providing assistance to ships operating in Canadian ice infested waters. These functions would be enhanced by having a work and safety vehicle. This vehicle will normally be carried on board our largest ice-breaking vessel the CCGS Louis St-Laurent. This vehicle type will be available to any vessel deployed to the arctic or ice infested waters. The first objective of the vehicle is to provide a safety support vehicle for Arctic operation but it would also be used as a very useful working unit to carry personnel and cargo over water, ice, land and perform limited amounts of icebreaking in shallow waters. In addition, secondary uses for this vehicle can be achieved through road delivery or aircraft delivery for the purpose of remote work and/or accessing rescue sites over terrain which is not accessible to other types of vehicles.

Status: Phase I completed. Phase two - Construction of an Arktos-Beta - is soon to be underway. This phase will be managed by Harry Martin, Project Manager and Miriam Van Roosmalen, Project Officer.

Reports/Deliverables: Final report for Phase I.

**Industrial/Scientific/
Technical Opportunity:** The delivered vehicle will be a 100% Canadian product that has unmatched abilities and may have potential for export markets. The new technology developed for this vehicle to operate in extreme arctic conditions is an important step in research and development of arctic safety and transportation systems. The vehicle has commercial applications for oil exploration and other arctic operations (possibly military and servicing radar and air defence systems) and could become a leader on the national and international market.

Project Number: 2952

Key Result Area: Fleet: Ships
Fleet Program Area:

Project Title: Effect of Welding Process and Parameters on
Weldability of Selected Primers

Project Officer: Mr. L.D. Parkinson, Coast Guard Fleet Systems,
Ottawa, 998-1777

Contractor/Performer: Arctec Canada Limited

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
COG	-	51	76	127
EMR	-	15	-	15
DSS	-	25	-	<u>25</u>
				167

Project Description:

It is the practice of the shipbuilding industry to coat steels with a primer in order to protect it from atmospheric corrosion until such time as it is ready for welding, assembly on the berth, and then final painting of the structure.

Manufacturers of these primers claim that their products have no detrimental effects on deposited weld metal. These claims are seldom substantiated adequately and International Welding Standards, Classification Societies and COG SSB do not specify requirements in this regard.

This project assesses the effects of primers (inorganic zincs, vinyls, catalyzed epoxies); primer application (thickness, surface finish); and, welding related variables (process, consumables, heat input) on deposited weld soundness.

The project is complementary to investigations initiated by DND. This project does not duplicate previous work undertaken by DND, rather it extends adequate performance specifications in an attempt to reduce the risk of weld metal fracture in ice transiting vessels.

Status: Contract is progressing well with no foreseen slip-page. Milestone #1, #2 & #3 were largely completed by 87/88 year end.

Reports/Deliverables: Interim report targeted for September, 1988. Final report targeted for March, 1989.

**Industrial/Scientific/
Technical Opportunity:** No undue business or financial risk is foreseen as the work objectives are well defined and all test procedures are standard in nature.

Project Number: 2975

Key Result Area: Fleet: Ships
Fleet Program Area:

Project Title: M.V. Arctic Weld Corrosion Study

Project Officer: Mr. L.D. Parkinson, Coast Guard Fleet Systems,
Ottawa, 998-1777

Contractor/Performer: Centre for Frontier Engineering Research

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	44	17	25	86
				<u>86</u>

Project Description: The MV Arctic Weld Corrosion Study is a four(4) year program designed to monitor real time corrosion characteristics of welds located in the shell envelope of Ice Transiting Ships. The program is also intended to correlate actual inservice corrosion rates with laboratory prediction methods such as synthetic seawater tank testing, anodic dissolution tests and potentiastatic polarization tests.

During the MV Arctic's new bow installation and hull modifications at Port Weller Dry Docks in 1985/86 a series of five(5) weld metal compositions were deposited on the ships hull in selected locations. Joining three(3) grades of shipbuilding steels. When applying the low friction coating each zone (approximately 1 metre in length) was masked so that welds in each location would be unprotected and exposed to ice abrasion and, cold (1°C) highly oxygenated ("20ppm) seawater during the three year field assessment monitoring period.

Status: The fifth field inspection was carried out in Montreal, Quebec on May 12, 1988. Corrosion trends were noted. The sixth field inspection should be completed by January, 1989.

Reports/Deliverables: An interim report summarising the activities of the first two fiscal years was issued February 12, 1987.

The Third Field Inspection Report is also now available.

All interim reports are of a restricted status until the final report is issued as a TP publication in 1989.

**Industrial/Scientific/
Technical Opportunity:** At completion, this study will provide the information necessary to allow fleet owner/operators and shipbuilder/designers to select more appropriate weld metal compositions based on the results from various laboratory test methods used for prediction corrosion.

Project Number: 2982

Key Result Area: Fleet: Ships
Fleet Program Area:

Project Title: RHI Launch/Recovery System (4R 18')

Project Officer: Mr. R.G. Cordick, Coast Guard Fleet Systems,
Ottawa, 998-1662

Contractor/Performer: The Cord Group Limited
Schat Davit Systems Canada

Financial Schedule	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	47	227	-	<u>274</u>
				274

Project Description: Test the Miranda Davit Launch and Recovery System (LRS) for its Rigid Hull Inflatable (RHI) small craft application over a wide range of sea states. Evaluate the system's efficiency over the conventional crane launch and recovery method. Develop a standardized LRS suitable for use on all applicable CCG vessels.

Status: Completed.

Reports/Deliverables: "Miranda" Davit Launch/Recovery System for Rigid Hull Inflatable (RHI) Boats, The Cord Group Limited, March 1988.

- A new system (re-designed Miranda Davit) developed for CCG operations.

Industrial/Scientific/
Technical Opportunity: N/A

Project Number: 2983

Key Result Area: Fleet: Ships
Fleet Program Area:

Project Title: Shipboard Integrated Navigation and Display Systems
(SINADS) (Reduced Visibility/Buoy Laying and
Checking)

Project Officer: Mr. J. Quinn, Coast Guard Fleet Systems,
Ottawa, 998-1607

Contractor/Performer: Offshore Systems Limited/MacDonald Dettwiler

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
COG	-	62	-	62
TDC	-	240	-	240
DSS	500	-	-	<u>500</u>
				802

Project Description: The purpose of this project is to develop and evaluate a hardware and software system that will integrate various ships navigational sensors including marine radar, provide collision avoidance capability and superimpose this data on multiple colour electronic charts displayed on a bridge mounted digital display.

The use of superimposed information from various sources such as electronic hydrographic charts, microwave transponders, radar imagery etc. will result in improvements to confined-waters navigation which will benefit a variety of users including narrow channel operators (ferry services on both East and West coasts), northern ports maneuvering by Canadian Coast Guard (COG) and general traffic.

Status: -

Reports/Deliverables: -

Industrial/Scientific/ Technical Opportunity: The technical risk is moderate in that the technique is proven. Reproducibility accuracy and acceptability of electronic placing of floating aids, however, may not be achieved as the relative cost of conducting the program is small with respect to potential benefits.

APPENDIX C

Research & Development and Engineering Studies Plan
(RD&ES)

APPENDIX C

1978/88 RD&ES PLAN BY KEY RESULT AREA
(KRA) AND SOURCE OF FUNDS

KRA	RD&ES Plan 000's	COGLA 000's	EMR 000's	DOE 000's	OTHER 000's	TOTAL
Short Range Aids to Navigation	429	-	-	-	-	429
Ship Safety	348	15	50	160	120	693
Safety & Public Correspondence Communication	200	-	-	-	-	200
Vessel Traffic Services	43	-	-	-	-	43
Emergencies	97	-	-	-	-	97
Waterways Development, Maintenance & Protection	8	-	-	-	-	8
Search & Rescue Operations	232	-	-	-	-	232
Direction and Administration	15	-	-	-	-	15
TOTAL	1,372	15	50	160	120	1,717

RESEARCH & DEVELOPMENT AND ENGINEERING STUDIES PLAN
1987/88 PROGRAM SUMMARY BY PROJECT
AND KEY RESULT AREA

KRA	PROJECT #	PROJECT TITLE	1987/88 EXPENDITURES 000's
Short Range Aids to Navigation (Appendix C.1)	2095	Materials Research	25
	2101	Colour Perception of Yellow Buoys and Lights	7
	2109	Review of Buoy Cleaning and Painting Facilities	12
	2113	Diesel Generator System - Mark I	22
	2126	Loran C Coverage Evaluation Instrumenta- tion Package	7
	2132	Evaluate Methods of Transmitting Data Between SAR Vessels and RCC	15
	2140	VHF Intermod Interference Investigation	23
	2143	Development of a Hybrid Solar - Diesel Power System for VHF Mountaintop Sites	20
	2144	Ice Force Research - Ontario	40
	2148	Development of Lightweight Buoys	18
	2150	Yamachiche Ice Force Measuring System	7
	2155	Ice Load Panels	2
	2159	Testing & Evaluation of Mooring Systems	1
	2161	Analysis of Buoy Radar Ranges	22
	2162	Determination of Nominal Visual Range Buoy	7
	2163	Prototype Buoy Cleaning and Painting Equipment	44
	2268	Development and Testing of High Performance Coating System for Buoys	74

RESEARCH & DEVELOPMENT AND ENGINEERING STUDIES PLAN

(Continued)

KRA	PROJECT #	PROJECT TITLE	1987/88 EXPENDITURES 000's
Ship Safety (Appendix C.2)	2321	RACON Improvements	44
	2768	VBB Ice Force - Structures	39
	2115	Development & Testing of Insulated Buoyant Deck Work Suits	105 ¹
	2127	Rating of Pleasure Craft for Recommended Engine Power	32
	2128	Introduction to Computer Program Analyses	13
	2165	Biological Control of Methane in Coal Mines, Coal Silos and Ship Holds	145 ²
	2281	Newfoundland Offshore Trials	270 ³
	2282	Fishing Vessel Stability Phase II, Analysis	47
	2786	MODU Stability Study Phase II	2
	2787	Fatigue Damage Assessment of Partial Penetration Deck Edge/Sheerstrake Connection as Fitted on Board a Canadian Ocean-Going Bulk Carrier	79
Safety & Public Correspondence Communication (Appendix C.3)	2443	Solid State CMB Testing	70
	2444	Navtex Service Trial	22
	2445	Synthetic Speech Reproducer for CMB	21
	2446	Remote Maintenance Monitoring System (RMMS)	87

1. \$90K - CCG/RD&ES
\$15K - COGLA

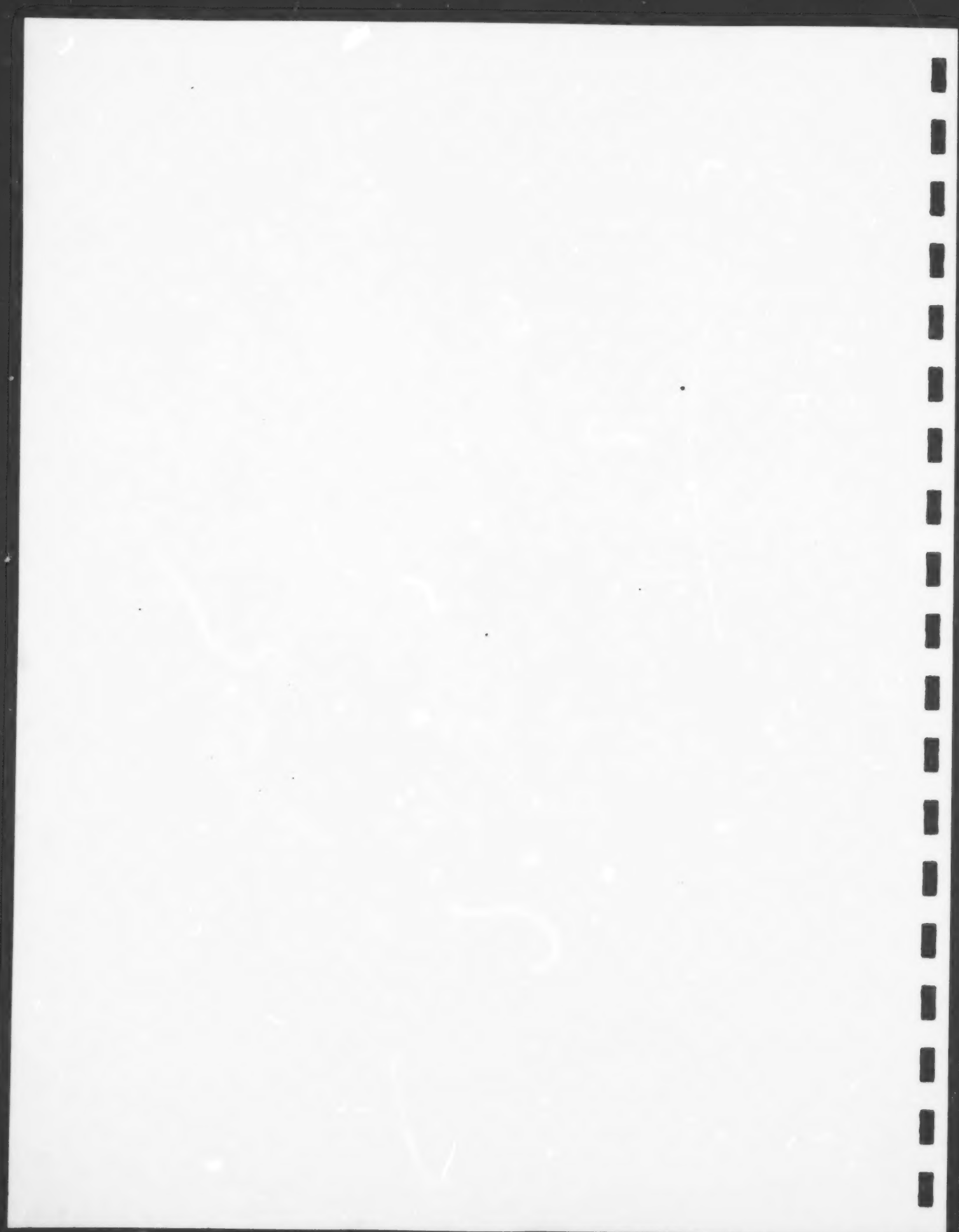
2. \$45K - CCG/RD&ES
\$50K - EMR/CANMET
\$50K - OTHER

3. \$ 40K - CCG/RD&ES
\$160K - DOE
\$ 70K - U.S.A.

APPENDIX C.1

Research and Development and Engineering Studies Plan
(RD&ES)

Short Range Aids to Navigation



Project Number: 2095

Key Result Area: Short Range Aids to Navigation

Project Title: Materials Research

Project Officer: Mr. T.P. Hodgson, Coast Guard Aids and Waterways,
Ottawa, 998-1407

Contractor/Performer: Various manufacturers and consultants

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
	-	25	220	245
				<u>245</u>

Project Description: The work involves researching and testing materials which will result in lower maintenance costs and/or longer life for CCG facilities such as buildings, towers, daymarks, heliports, etc. The work will be carried out as follows:

1. Carry out a literature search for new materials on the market, or new applications for old materials.
2. Purchase and test materials which appear promising.
3. Compare performance and cost of new material to that of existing materials.
4. Write reports on new materials outlining test results, design considerations, codes and standards applicable to the new materials.
5. Hire consultants to carry out specialist research as necessary.

Status: -

Reports/Deliverables: -

**Industrial/Scientific/
Technical Opportunity:** This research will give Canadian manufacturers the opportunity to consider new uses and applications for their products. For instance durable low maintenance modular buildings developed for use at lightstations may also be of interest to other government departments or the private sector. The research will be done in cooperation with the regions manufacturers, consultants and the NRC. Risks are nil.

Project Number: 2101

Key Result Area: Short Range Aids to Navigation

Project Title: Colour Perception of Yellow Buoys and Lights

Project Officer: Mr. D. Long, Coast Guard Aids and Waterways,
Ottawa, 998-1392

Contractor/Performer: -

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	-	7	-	<u>7</u>
				7

Project Description: The purpose of this project is to efficiently develop, provide and operate, or assure the efficient operation of, the specific marine facilities and services that are essential to the national transportation system and that are within the federal government's jurisdiction. In particular, during the first season of use, the yellow buoys and buoy lights were observed as red under certain atmospheric conditions. The misinterpretation of the colour of a buoy or its light could have serious consequences. Problems which have been experienced will be assessed to determine their probable cause. Steps will be taken to determine by theory or practice the solution(s) (if any) to the problems being experienced and develop data to support any conclusions reached.

Status: -

Reports/Deliverables: -

Industrial/Scientific/
Technical Opportunity: If it is determined that the yellow lenses produced by lantern manufacturers are observed as red under certain atmospheric conditions, the results of the study could result in product changes for the benefit of the marine industry.

Project Number: 2109

Key Result Area: Short Range Aids to Navigation

Project Title: Review of Buoy Cleaning and Painting Facilities

Project Officer: Mr. D. Long, Coast Guard Aids and Waterways,
Ottawa, 998-1392

Contractor/Performer: N/A

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
	-	12	34	<u>46</u>
				46

Project Description: The purpose of this project is to assess the requirements of each Coast Guard Base for buoy cleaning and painting and of the degree to which this requirement is not presently being met. Identification and assessment of alternative ways of meeting this requirement (eg. Contracting out), including recommendations. The preparation of general specifications and/or performance requirements for all equipment and structures required to carry out the required cleaning and painting effectively, efficiently and safely will be assessed along with the preparation of cost estimates for new equipment and structures.

Status: -

Reports/Deliverables: -

**Industrial/Scientific/
Technical Opportunity:** Through this project and others (ie: 2268 and 2163), the marine coatings industry will benefit from the experience gained in the application and testing of modern high performance coatings and in the purpose specific design of facilities for their application.

Project Number: 2113

Key Result Area: Short Range Aids to Navigation

Project Title: Diesel Generator System - Mark I

Project Officer: T.P. Hodgson, Coast Guard Aids and Waterways,
Ottawa, 998-1407

Contractor/Performer: -

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	-	22	-	<u>22</u>
				22

Project Description: The objective of this project is to provide a remote, unattended, reliable, low maintenance 'navaid' system for year-round high arctic operation. Ongoing maintenance and repairs will be to the following equipment:

Navaid System

Diesel generator units
Solid state controllers and charging rectifiers
Main station battery equipment

Wind generator system

Wind generator power module maintenance
Mast assembly and guys
Control system and main battery maintenance

General

Building upkeep (3 off)
Power distribution, AC and DC voltage systems

Status: -

Reports/Deliverables: -

Industrial/Scientific/
Technical Opportunity: There has to date been considerable spin-off to industry on the basic 'cycle-charge' power system. In both the basic design, and adaptations of the concept, contracts totalling over \$6,000,000.00 have been realized.

Project Number: 2126

Key Result Area: Short Range Aids to Navigation

Project Title: Loran C Coverage Evaluation Instrumentation Package

Project Officer: F.J. Forbes, Coast Guard Telecommunications and Electronics, Ottawa, 996-1545

Contractor/Performer: Atlantic Electronics
Electrosonic

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
	-	7	-	<u>7</u>
				7

Project Description: To evaluate the Loran C navigational system to ensure it meets published performance standards for availability, reliability and repeatability at minimum cost, thus allowing for greater flexibility.

The automated monitor system will incorporate the following features and advantages:

1. Allow larger number of user receivers to be interfaced which are more representative of clients equipment, provide better performance and allow comparative evaluation of different receivers.
2. Dissipate less heat and inject less RF noise.
3. Occupy less space and be easily transportable in a van or vessel.
4. Produce acquisition performance charts under the control of an IBM PC, with data supplied on IBM formatted diskettes.
5. Professional, easy to learn, user interface.

6. Print Lat./Long. and signal strength numbers, if available.
7. Automate monitor process to eliminate manual data entry via keyboard.

Status: Completed.

Reports/Deliverables: System Manual for Loran-C Data Acquisition System,
July, 1987

**Industrial/Scientific/
Technical Opportunity:** Meets COG requirements to monitor and ensure that the
Loran C System meets its designed objectives. The
system will provide cost savings as well as provide
standardized report formats.

Project Number: 2132

Key Result Area: Short Range Aids to Navigation

Project Title: Evaluate Methods of Transmitting Data Between SAR Vessels and RCC

Project Officer: G.K. Running, Coast Guard Telecommunications and Electronics, Vancouver, (604) 984-3870

Contractor/Performer: Tech West

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	-	15	4	<u>19</u>
				19

Project Description: While conducting searches for missing craft, Search and Rescue vessels need to be able to transmit their locations and the areas they have searched to the Rescue Coordination Centre. The search pattern information is currently stored in video plotting equipment and manually sent to RCC by voice communication. The work will consist of a theoretical study of methods, procedures and frequency bands to be used for the transmission of data. An evaluation of the type of equipment to be used and a series of field tests will be conducted to verify the results of the study.

Status: Completed.

Reports/Deliverables: Evaluation of ship location and Reporting System available end of July, 1988

Industrial/Scientific/
Technical Opportunity: N/A

Project Number: 2140

Key Result Area: Short Range Aids to Navigation

Project Title: VHF Intermod Interference Investigation

Project Officer: A.K. Khan, Coast Guard Telecommunications and Electronics, Ottawa, 998-1530

Contractor/Performer: Comprod Communication Ltd., Montreal, Quebec
Advanced Tower Ltd., Elmira, Ont.
Sinclair Radio Laboratories Ltd., Aurora, Ont.
PG Electronics Ltd., Weston, Ont.

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	-	23	-	23
				23

Project Description: The objective of this project is to provide the ship/shore maritime mobile communication service for safety in order to minimize the risk to life and property at sea and in navigable Canadian waters. A laboratory set up consisting of 2 VHF transmitters, 3 cavity filter systems and 1 selective RF-microvoltmeter would be used to measure the IM generating properties of various items used in a typical VHF installation. Tests would be conducted on antennas, cavities, and installation materials provided by the Regions in both new and deteriorated condition. Evaluation of new items provided by commercial suppliers on a loan or purchase basis will also be performed. Available research reports by other agencies will be used to the extent they are applicable and no duplication of such work is intended.

Status: -

Reports/Deliverables: Not Complete.

Industrial/Scientific/
Technical Opportunity: The results of the investigation could provide manufacturers with information for product improvements to reduce IM generation. The results would also be of interest to CBC, DND, AES, Bell Canada, CN/CP and other users of VHF/UHF communications.

Project Number: 2143

Key Result Area: Short Range Aids to Navigation

Project Title: Development of a Hybrid Solar-Diesel
Power System for VHF Mountaintop Sites

Project Officer: H. Ashworth, Regional Superintendent,
Engineering Services (FMAD)

Contractor/Performer: N/A

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
	-	20	9	29
				29

Project Description: Power requirements for VHF mountaintop repeater sites are presently provided by continuously running diesel generators. Solar panels have been installed at one of the sites, but considerable potential for fuel savings exist. A significant portion of this potential can be realized through installation of larger alternators with the existing engines and a control system which will run the engines through a specified charging sequence if the solar panels have not maintained adequate charge on the battery bank. As the cost of fuel and its delivery by helicopter continues to be prohibitive, this more efficient and cost effective method of power generation is proposed. The objective then, is to develop and install an efficient hybrid solar-diesel power system for a 400 watt load at VHF mountaintop sites.

Status: -

Reports/Deliverables: -

Industrial/Scientific/ N/A
Technical Opportunity:

Project Number: 2144

Key Result Area: Short Range Aids to Navigation

Project Title: Ice Force Research - Ontario

Project Officer: Mr. T.P. Hodgson, Coast Guard Aids and Waterways,
Ottawa, 998-1407

Contractor/Performer: National Research Council (NRC)

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
	-	40	84	<u>124</u>
				124

Project Description: The objective is to be able to select the correct ice force design pressures for the application of codes used to design offshore structures such as fixed navigational aids. The purpose of this work is to collect ice force data to compare to existing data collected at Yamachiche Curve. The data collected to date indicates that design ice force pressures can be reduced. If this data can be confirmed with data from a new site with different environmental conditions, it would enable us to establish new lower ice force pressures for the design of our lightpiers which would result in substantial cost savings in the construction of new lightpiers. These lightpiers which are fixed aids support the safe and efficient development of a national marine transportation system.

Status: -

Reports/Deliverables: -

Industrial/Scientific/
Technical Opportunity: If lower design ice loads are justified, substantial savings in construction cost of new lightpiers will be realized. Information will be shared with the scientific community through technical papers and conferences. No business or technical risks are foreseen. The technology to measure ice forces is currently available and has been used successfully at Yamachiche Curve.

Project Number: 2148

Key Result Area: Short Range Aids to Navigation

Project Title: Development of Lightweight Buoys

Project Officer: Mr. T.P. Hodgson, Coast Guard Aids and Waterways,
Ottawa, 998-1407

Contractor/Performer: Gilman Corp & Dupont Canada

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
	134	18	26	<u>178</u>
				178

Project Description: The development of lightweight buoys has as its background, the need for a reduction in the cost of buoy transportation and handling both ashore and afloat. Rugged and reliable lightweight major buoys are not commercially available. Designs using marine grade aluminum alloys and cross-linked polyethylene are being developed and tested in-house by CCG. The project will investigate use of lightweight plastics and aluminum alloys for buoy designs; manufacture test designs for representative sizes; carry out evaluations and standardize where successful.

Status: -

Reports/Deliverables: -

Industrial/Scientific/ Technical Opportunity: New standard, mission related equipment. Reduced O&M.

Project Number: 2150

Key Result Area: Short Range Aids to Navigation

Project Title: Yamachiche Ice Force Measuring System

Project Officer: Mr. T.P. Hodgson, Coast Guard Aids and Waterways,
Ottawa, 998-1407

Contractor/Performer: National Research Council

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
	239	7	6	<u>252</u>
				252

Project Description: The objective is to obtain ice pressures for use in the design of lightpiers and other marine works in order to provide accurate field data on ice forces. There will be a redesign and purchase of a new electronic system, as well as modification of ice force panels (installation and calibration) over a five year period.

Status: -

Reports/Deliverables: Physical ice force measuring system. Data on ice forces during winter of 1983-84, 1984-85, 1985-86 and 1986-87; reports available. Report for 1987/88 is anticipated.

Industrial/Scientific/
Technical Opportunity: Knowledge sharing with scientific community; technical papers will be written and presented at conferences. IALA Ice Force Technical Committee has prepared design code. Paper was presented at Canadian Coastal Conference in August 1985. Paper was presented at 8th international symposium on Ice sponsored by IAHR in August 1986. Other conference papers are planned.

Project Number: 2155

Key Result Area: Short Range Aids to Navigation

Project Title: Ice Load Panels

Project Officer: Mr. T.P. Hodgson, Coast Guard Aids and Waterways,
Ottawa, 998-1407

Contractor/Performer: -

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	50	2	-	<u>52</u>
				52

Project Description: The objective is to be able to select the correct design ice force pressure for the application of codes used to design offshore structures such as fixed navigational aids. The project includes an instrumentation system for Curve No. 1 and ice force measuring systems at 4 new piers in Central Region.

Status: -

Reports/Deliverables: -

Industrial/Scientific/
Technical Opportunity: Knowledge sharing with scientific community; knowledge of ice forces. Knowledge will be presented at conferences and in scientific journals. There are no significant risks.

Project Number: 2159

Key Result Area: Short Range Aids to Navigation

Project Title: Thrash Chains in Mooring System

Project Officer: Mr. T.P. Hodgson, Coast Guard Aids and Waterways,
Ottawa, 998-1407

Contractor/Performer: N/A

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
	-	1	82	<u>83</u>
				83

Project Description: To carry out a survey of IALA members to determine what sizes and configurations of thrash chain systems are in use. Based on results, specify and purchase test chain. To carry out a comparative study on the East Coast, involving several buoys with standard moorings, and several buoys with moorings incorporating thrash chains. Monitor wear rates of moorings, and attachment points at anchor and at buoy. Prepare report and recommend new mooring configuration if necessary. Investigate surface treatments and/or finishes to see if these have a beneficial effect on mooring life. Investigate synthetic mooring lines if potential exists for life extension.

Status: -

Reports/Deliverables: -

Industrial/Scientific/
Technical Opportunity: Scientific opportunities, development of mooring design parameters which may be used for ODAS buoys and possibly buoyage systems for offshore rigs.

Project Number: 2161

Key Result Area: Short Range Aids to Navigation

Project Title: Analysis of Buoy Radar Ranges

Project Officer: Mr. D.A. Long, Coast Guard Aids and Waterways,
Ottawa, 998-1392

Contractor/Performer: Arctec Canada Limited

Financial Schedule:	<u>Previous</u> <u>Years</u>	<u>87/88</u>	<u>Future</u> <u>Years</u>	<u>TEC</u>
	17	22	-	39
				39

Project Description: Phase I - Determine the characteristics (eg. antenna height, peak transmitted power, wavelength, antenna gain, etc.) of the stereotype radar set used by commercial shipping, commercial fishing and pleasure craft. Determine the theoretical radar range of each buoy type for each of the given stereotype radar set.

Phase II - Substantiate the data of Phase I with actual in-field testing, and corrolate this data with various climatic conditions.

Status: Phase I is completed; Phase II will be carried out in 1987/88. Standards are to be published by March 31, 1988.

Reports/Deliverables:

- Interim Report on Phase I (theoretical calculations)
- Computer Program for Theoretical Calculations of Radar Range

**Industrial/Scientific/
Technical Opportunity:**

- Industrial opportunity minimal
- Scientific opportunity: The result of the study will provide new information on the performance parameters of various types of radar reflectors in use.

Project Number: 2162

Key Result Area: Short Range Aids to Navigation

Project Title: Determination of Nominal Visual Range Buoy

Project Officer: Mr. D.A. Long, Coast Guard Aids and Waterways,
Ottawa, 998-1392

Contractor/Performer: Brian W. Tansley Ph.D.

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	21	7	-	28
				28

Project Description: Carry-out the necessary theoretical and practical tests and evaluations to determine the nominal visual range of each buoy type in various visibility conditions.

Status: Theoretical calculations were completed. Field trials to verify data are in progress.

Reports/Deliverables:

- Interim Report on the Theoretical Calculation of Visual Ranges, March 27, 1987
- Final Report, March 31, 1988
- Computer Program to Determine Buoy Visual Ranges, March 1988

Industrial/Scientific/
Technical Opportunity: Minimal industrial opportunity.

Project Number: 2163

Key Result Area: Short Range Aids to Navigation

Project Title: Prototype Buoy Cleaning and Painting Equipment

Project Officer: Mr. D.A. Long, Coast Guard Aids and Waterways,
Ottawa, 998-1392

Contractor/Performer: Mr. Sullivan & Son Limited
Correspec Consultants Incorporation
Wheelabrator Corporation of Canada Limited

Financial Schedule:	<u>Previous</u> <u>Years</u>	<u>87/88</u> <u> </u>	<u>Future</u> <u>Years</u>	<u>TEC</u> <u> </u>
	354	44	-	<u>398</u>
				398

Project Description: Evaluate new state-of-the-art buoy cleaning and painting equipment at Prescott Base in order to prepare specifications for a standard installation from which equipment may be selected to modernize buoy maintenance buildings at other CCG bases.

Status: New modern paint and air blast equipment has been partially installed. Minor technical problems were encountered during equipment fabrication and initial installation, but these are not expected to affect performance.

Reports/Deliverables: Final Report, December 1987

**Industrial/Scientific/
Technical Opportunity:** The results of the evaluation of the new equipment in the application of new paint systems will be of benefit to the marine coating industry.

Project Number: 2268

Key Result Area: Short Range Aids to Navigation

Project Title: Development & Testing of High Performance Coating System for Buoys

Project Officer: Mr. D.A. Long, Coast Guard Aids and Waterways, Ottawa, 998-1392

Contractor/Performer: Correspec Consultants Incorporation

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
	118	74	63	255
				255

Project Description:

The objective is to develop a long life coating system for buoys which will enable buoys to remain on-station, without repainting for at least five (5) years. A phased approach will be taken as follows:

- Phase 1 - market study - selection of systems to be tested;
- Phase 2 - application of test system;
- Phase 3 - preparation of a visual standard to govern the maintenance of paint systems;
- Phase 4 - inspection of test systems in years 1986 - 1992.

During phase 1, a total of 41 systems were recommended and accepted for testing. The overwhelming response can be attributed to both an underestimation of developments in the paint industry, as well as keen interest on the part of the paint industry as a whole. All participating companies supplied test materials free of charge to the Coast Guard and, in many cases, they supplied the technical personnel and application equipment required to apply their products.

Continuing interest in the program has resulted in requests from several additional companies to have their products included, leading to 7 more paint systems being applied to buoys at Quebec and Victoria Bases. The milestone dates for phases 2 and 4 have been adjusted accordingly.

Status:

-

Reports/Deliverables:

Report on Coast Guard buoy cleaning and painting facilities at the Bases used for test paint applications.

**Industrial/Scientific/
Technical Opportunity:**

The marine coatings industry will benefit from the controlled testing of new products and systems and from test reports. New marketing and promotional opportunities are likely results for industry.

Project Number: 2321

Key Result Area: Short Range Aids to Navigation

Project Title: RACON Improvements

Project Officer: J.W. Scollick, Coast Guard Telecommunications and Electronics, Ottawa, 998-1544

Contractor/Performer: Medisco & Aydin

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	79	44	30	<u>153</u>
				153

Project Description: The immediate task is the completion of tests on a RACON by Tidelands Corporation. This project may involve laboratory evaluation of new FARS to determine equipment reliability and maintenance procedures and evaluation of handheld field test units. In future years, methods of reducing both RACON sensitivity and power output for short range applications such as bridge pier marking, in order to improve RACON response definition, will be evaluated. The ITOFAR technique requires a minor modification to the ship radar display system which would also have to be evaluated and modification procedures developed.

Status: The primary activity in 1987/88 was the production of test sets for Regional RACON depots. In addition, four S-Band Signal generators were purchased for use with the test sets, for those Regions which lacked this equipment. As a result, all regions are now equipped to carry out RACON maintenance at specified repair depots.

Tideland Signal Corporation conducted a series of tests on a new RACON in the interest of establishing its suitability as a candidate unit in any new RACON procurement.

Reports/Deliverables: TP.8937E - Test and Evaluation: 'Seabeacon'
Mark III, Vol. 1 and 2

**Industrial/Scientific/
Technical Opportunity:** Anticipated benefits will include mission related
equipment, improved identification of landfalls,
danger areas, etc. by ship radar. Technical risks
are a minimum.

Project Number: 2768

Key Result Area: Short Range Aids to Navigation

Project Title: VBB Ice Force - Structures

Project Officer: Mr. T.P. Hodgson, Coast Guard Aids and Waterways,
Ottawa, 998-1407

Contractor/Performer: VBB Consultants, Sweden

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	5	39	22	<u>66</u>
				66

Project Description: The present contract is an International research project carrying out ice research in the Baltic Sea in conjunction with ice research specialists from Sweden, Japan, Germany & USA. This cooperative effort will assist in accelerating Canadian research and will lead to the confirmation of preliminary findings by the AMADC research team who are conducting ice research in Lac St. Pierre. The actual work involves the instrumentation of an existing pier in the Baltic Sea. Results from the action of ice on the pier will enable the research team to determine the magnitude of the ice force on piers.

Status: N/A

Reports/Deliverables: Reports will be available quarterly and at the end of each major task.

Industrial/Scientific/
Technical Opportunity: The Ice Pressuremeter Technique developed by COG was used in the 1986/87 Winter season and will be used in the 1987/88 season.

APPENDIX C.2

Research and Development and Engineering Studies Plan
(RD&ES)

Ship Safety

Project Number: 2115

Key Result Area: Ship Safety

Project Title: Development & Testing of Insulated Buoyant Deck Work Suits

Project Officer: Mr. T. Mangan, Coast Guard Ship Safety,
Ottawa, 991-3125

Contractor/Performer: The Cord Group Limited

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
COG	-	90	-	90
COGLA	-	15	-	<u>15</u>
				105

Project Description: This project is to develop a thermal protective device for each person onboard small fishing vessels, as well as an appropriate testing procedure. The primary objectives are to:

1. Determine the concept of a Thermally Protective Work Suit.
2. Develop a Standard.
3. Develop the criteria for Thermal Protection.
4. Develop a test procedure to determine thermal protection.
5. Test prototype thermal work suit.

Status: The overall objective of this project was achieved well in advance of the targeted completion date. Target dates and costs were met throughout the project. Responsiveness to user needs was excellent as was the quality of workmanship. This project was handled with expediency and professionalism by the contractor. Many tests used were developed specifically for the project and will be incorporated into the final "Standard for Insulated Buoyant Deck Work Suits".

Reports/Deliverables: -

Industrial/Scientific/ Technical Opportunity: The project involves the development of a new type of testing, and methods of determining thermal protection measurement.

Project Number: 2127

Key Result Area: Ship Safety

Project Title: Rating of Pleasure Craft for Recommended Engine Power

Project Officer: D. Jenkins, Coast Guard Ship Safety,
Ottawa, 991-3129

Contractor/Performer: Allied Boating Association of Canada

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	-	32	-	<u>32</u>
				32

Project Description: This project will be conducted in conjunction with boat and engine manufacturers (using as a main, but not exclusive, source the manufacturers' association, Allied Boating Association of Canada). The project will involve the assembling of test subjects, the establishment of a test course on the water, (at a location to be determined), and the obtaining of measuring equipment, test boat drivers and qualified observers.

Status: The validation part of the project (extending rating curves from 5.0 metres to 6.0 metres in length) was successful but poor industry response meant that an insufficient number of test subjects were available in the upper range. Since industry response was low, overall expenditure was one third the expected cost (35K instead of the allocated 100 K).

Reports/Deliverables: -

Industrial/Scientific/
Technical Opportunity: The project will be conducted in conjunction with boat and engine manufacturers.

Project Number: 2128

Key Result Area: Ship Safety

Project Title: Introduction to Computer Program Analyses

Project Officer: Mr. J. Archibald, Coast Guard Ship Safety,
Ottawa, 991-3177

Contractor/Performer: -

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	-	13	195	208
				208

Project Description: Ship Safety is responsible for the approval of the design of vessels and offshore structures. To assist in this responsibility a Microvax II computer-aided design system is being acquired. In order that this system will be used to its maximum potential it will be necessary to acquire and possibly adapt existing programs or develop new programs relating to design analysis and regulatory approval.

The project will assess vessel survivability through the development of an advanced computer system for the investigation and ultimate determination of safety criteria for the regulatory approval of designs for marine vehicles.

The work is done in phases with Phase I analysing existing programs for applicability and compatibility. Phase II analysing and adapting suitable programs, and Phase III developing new programs where no program can be found to meet a particular Ship Safety requirement.

Status:

-

Reports/Deliverables:

-

Industrial/Scientific/
Technical Opportunity:

Programs would be developed basically for use by Ship Safety in the course of developing new regulations and standards for ultimately approving the design of ships and offshore structures. Industry would benefit from increased margins of safety afforded by the more thorough computer analysis of ship designs. There might also be benefits to industry as a result of possible revisions which could be less demanding than current regulatory requirements.

Project Number: 2165

Key Result Area: Ship Safety

Project Title: Biological Control of Methane in Coal Mines, Coal Silos and Ship Holds

Project Officer: Mr. R.H. Day, Coast Guard Ship Safety, Ottawa, 991-3142

Contractor/Performer: Gemini Biochemical Research Limited

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
CCG	105	45	35	185
EMR/CANMET	149	50	50	249
OTHER	-	50	50	<u>100</u>
				534

Project Description: Explosions have occurred on ships carrying coal, in particular coal from Cape Breton (DEVCO), as a result of the accumulation of methane gas from the coal in the ship's hold. These incidents have occurred in spite of the requirement to be provided with ventilation capability and the provision of safety notices highlighting the danger associated with this coal.

The objective of the project is to reduce the risk of explosion on coal carriers through the investigation of the possibility of developing a practical treatment for the coal which will eliminate or reduce the methane emissions.

The project involves determining methane concentrations and emissions in various coals, testing methods of reducing these emissions, testing the applicability of these methods for use at the coal mine or onboard the vessel, and eventual field testing by measuring the concentration of methane in a cargo hold.

Status: -

Reports/Deliverables: -

Industrial/Scientific/ Technical Opportunity: This project involves the development of a new methane reduction method for large scale use in coal mines and for onboard ships.

Project Number: 2281

Key Result Area: Ship Safety

Project Title: Newfoundland Offshore Trials

Project Officer: Mr. E. Gauthier, Coast Guard Emergencies
Ottawa, 990-3376

Contractor/Performer: S.L. Ross Environmental Research Ltd.

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
CCG	50	40	-	90
DOE	-	160	-	160
U.S.A.	-	70	70	<u>140</u>
				390

Project Description: The objective of this project is twofold: first, to determine whether or not the Canadian Coast Guard equipment stockpiled in St. John's is suitable for responding to spills of waxy oils on the Grand Banks, and second, to obtain sea-keeping and oil keeping data with an instrumented boom, using a system developed by the EPA Oil and Hazardous Material Simulated Environmental Test Tank (OHMSETT) facility staff.

Status: Completed.

Reports/Deliverables: Offshore Testing of Booms and Skimmers,
S.L. Ross Environmental Research Limited

**Industrial/Scientific/
Technical Opportunity:** An opportunity to obtain real time data which will allow the scientific community to develop the necessary computer software enabling the verification of new/modified oil spill containment devices in test banks. This is presently not possible because of the many unknown variables.

Project Number: 2282

Key Result Area: Ship Safety

Project Title: Fishing Vessel Stability Phase II, Analysis

Project Officer: Mr. D. Stocks and Mr. C. Wallace, Coast Guard
Ship Safety, Ottawa, 998-0595

Contractor/Performer: Institute for Marine Dynamics

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	99	47	50	<u>196</u>
				196

Project Description: During the first phase of this project (1983/84 to 1984/85) six Coast Guard selected captive models were manufactured, the required instrumentation for testing developed and capsizing tests conducted in Sweden (SSPA Maritime Consulting AB) with some preliminary analysis of results.

In Phase II the data obtained from Phase I is analysed to give the hydrodynamic forces and moment acting on the model in waves, the motion characteristics of the model, the correlation between the position of the model in waves and the forces and moments acting, and the kinematics of the motions. A computer software is to be developed for the computation of hydrodynamic forces in the time domain. This is fundamental to the numerical simulation of capsize events.

Future work in this phase involves the development of the theoretical model of ship capsizing in quartering seas.

Status: The study is progressing in accordance with project definition. Completion is planned for 1988/1989.

Reports/Deliverables: Final report at project completion.

**Industrial/Scientific/
Technical Opportunity:** New design standards for fishing vessels may result.

Project Number: 2786

Key Result Area: Ship Safety

Project Title: MODU Stability Study Phase II

Project Officer: Mr. B. Smyth, Coast Guard Ship Safety,
Ottawa, 998-0653

Contractor/Performer: American Bureau of Shipping (ABS)

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	25	2	7	34
				34

Project Description: Further investigation of the critical areas identified by the Phase I study (an analysis of the stability and motion characteristics of semi-submersible MODU's to determine the adequacy of current stability requirements) and others which are necessary for verifying the analytical predictions and for determining a clear trend in stability requirements.

Also, the evaluation of the existing criteria and further model testing including mooring effects are proposed.

Status: A preliminary report was presented to the International Marine Organization (IMO) by USOCG at the 30th Session of D&E Sub-Committee.

Reports/Deliverables: Final report on project completion (might be restricted if it conflicts with export control agreements).

Industrial/Scientific/
Technical Opportunity: Any new COG standards resulting from this study will be distributed worldwide.

Project Number: 2787

Key Result Area: Ship Safety

Project Title: Fatigue Damage Assessment of Partial Penetration
Deck Edge/Sheerstrake Connection as Fitted on Board
a Canadian Ocean-Going Bulk Carrier

Project Officer: Mr. D. Stocks, Coast Guard Ship Safety,
Ottawa, 998-0608

Contractor/Performer: British Maritime Technology
Welding Institute of Canada

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	30	79	50	<u>159</u>
				159

Project Description: Establish an operating lifetime expectancy of the deck edge connection for the subject vessel on ocean-going service, thus facilitating the appropriate certification of this and future vessels of similar design, in accordance with the requirements of the Canada Shipping Act.

The work is done in phases, each future phase will have the specific objective of establishing a higher level of confidence in the long term certification of vessels and will provide a review stage to decide if further work is appropriate.

Status: The work to date (Phase I) has identified areas of concern regarding the operating lifetime expectancy (fatigue damage) of the deck edge connection and its long term certification by Ship Safety. A Steering Committee consisting of Industry, Classification Society and ship owners has been formed to guide subsequent phases.

Reports/Deliverables: Phase I report, restricted distribution to Steering Committee. Final document at project completion will not be restricted.

**Industrial/Scientific/
Technical Opportunity:** The shipyard utilized this type of weldment (sheer-strake) as an economy measure and has expressed a desire to continue utilizing partial penetration weldment in such critical positions as deck edge ship side connections. If long term certification is granted the project could be of benefit to industry.

APPENDIX C.3

Research and Development and Engineering Studies Plan
(RD&ES)

Safety and Public Correspondence Communications

Project Number: 2443

Key Result Area: Safety and Public Correspondence Communication

Project Title: Solid State CMB Testing

Project Officer: Mr. W.G. Anderson, Coast Guard Telecommunications & Electronics, Ottawa, 998-1527

Contractor/Performer: Interallia Inc., Calgary, Alberta

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
	54	70	124	<u>124</u>
				124

Project Description: The project purpose is to determine the feasibility to replace aging electro-mechanical recorder equipment with a more cost effective solid state unit. Commercially available Solid State Recorders will be reviewed to determine which two evaluated recorders are best suited to Coast Guard requirements. Full technical and operational evaluations will be performed on recorders installed in radio stations to replace the existing CMB. An evaluation report with recommendations for a national replacement program will also be produced.

Status: State of the art technology was used to develop this all Solid State CMB. Both systems are functioning extremely well at the Vancouver and Montreal CGRS. These systems are now being considered for the national replacement program of electro mechanical CMB.

Reports/Deliverables: Completed.

**Industrial/Scientific/
Technical Opportunity:** No significant industrial benefits are anticipated since this type of equipment is commercially available. The evaluation may result in minor development activity to tailor the equipment to the particular Coast Guard application.

Project Number: 2444

Key Result Area: Safety and Public Correspondence Communication

Project Title: Navtex Service Trials

Project Officer: Mr. W.G. Anderson, Coast Guard Telecommunications & Electronics, Ottawa, 998-1527

Contractor/Performer: Cybectec,
Plan Data Electronics Ltd.

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
	37	22	-	59
				59

The major objective of the project is to demonstrate that commercially available equipment together with specialized software can be systematically integrated to comprise an efficient cost effective and reliable automatic NAVTEX transmission system. The service trial is proposed to be conducted from Sydney CGRS.

This objective will be achieved by:

1. carrying out a system design and functional software definition;
2. procuring all hardware and software for installation at Sydney CGRS; and
3. conducting a detailed operational and technical evaluation to assess actual versus predicted coverage, develop operational experience and standards, and refine operational procedures for increased efficiency and reliability prior to the installation of additional systems on a national basis.

Status: -

Reports/Deliverables: Report on NAVTEX Research and Development
Project, #2444

Industrial/Scientific/
Technical Opportunity: This project represents the first major step in
introducing automated systems to handle the new role
CGRS's will have to perform as part of the FGMDSS,
and as such may be the most automated NAVTEX system
internationally.

Project Number: 2445

Key Result Area: Safety and Public Correspondence Communication

Project Title: Synthetic Speech Reproducer for CMB

Project Officer: Mr. W.G. Anderson, Coast Guard Telecommunications and Electronics, Ottawa, 998-1527

Contractor/Performer: Hamilton Arnet
Digital Equipment
CAD Micro Solutions
Exceltornix

Financial Schedule:

<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
25	21	-	46
			46

Project Description: Review available technology and develop a package to replace the existing electro-mechanical systems with a more cost effective electronic system.

Status: The system has been procured and installed at the Thunder Bay Coast Guard Radio Station and a similar system will be installed at Sarnia CGRS in November 1988. The system at Thunder Bay is functioning well and performing as expected. The Sarnia system will provide two outputs carrying different information simultaneously and use a low cost speech synthesizer made by Speech Plus.

Reports/Deliverables: Final report will be available in conjunction with the report on the Solid State CMB Testing.

**Industrial/Scientific/
Technical Opportunity:** It is expected that much of the technology would be available. The development aspects of the project relate to the particular Coast Guard application, and might be of interest to other government departments, such as AES, but not to industry.

Project Number: 2446

Key Result Area: Safety and Public Correspondence Communication

Project Title: Remote Maintenance Monitoring System (RMMS)

Project Officer: Mr. W.G. Anderson, Coast Guard Telecommunications & Electronics, Ottawa, 998-1527

Contractor/Performer: Canadian Marconi
Hewlett Packard

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
	127	87	40	<u>254</u>
				254

Project Description: The project will explore the feasibility of developing a RMMS system (centre-to-multipoint) to conduct remote maintenance (via radio and/or telco circuits) for use in the Canadian Coast Guard. A software package will be modified and enhanced to meet centre-to-multipoint operation and the pros and cons of using the RMMS system as opposed to the conventional method of conducting routine maintenance will be evaluated.

Status: The HF remote maintenance monitoring (RMM) system was successfully installed at Killinek and Coral Harbour (NWT) during 1986. Performance measurements are being carried out and the final system evaluation report is expected to be completed by the end of December, 1988. The Harrington Harbour system is scheduled to be installed in January, 1989.

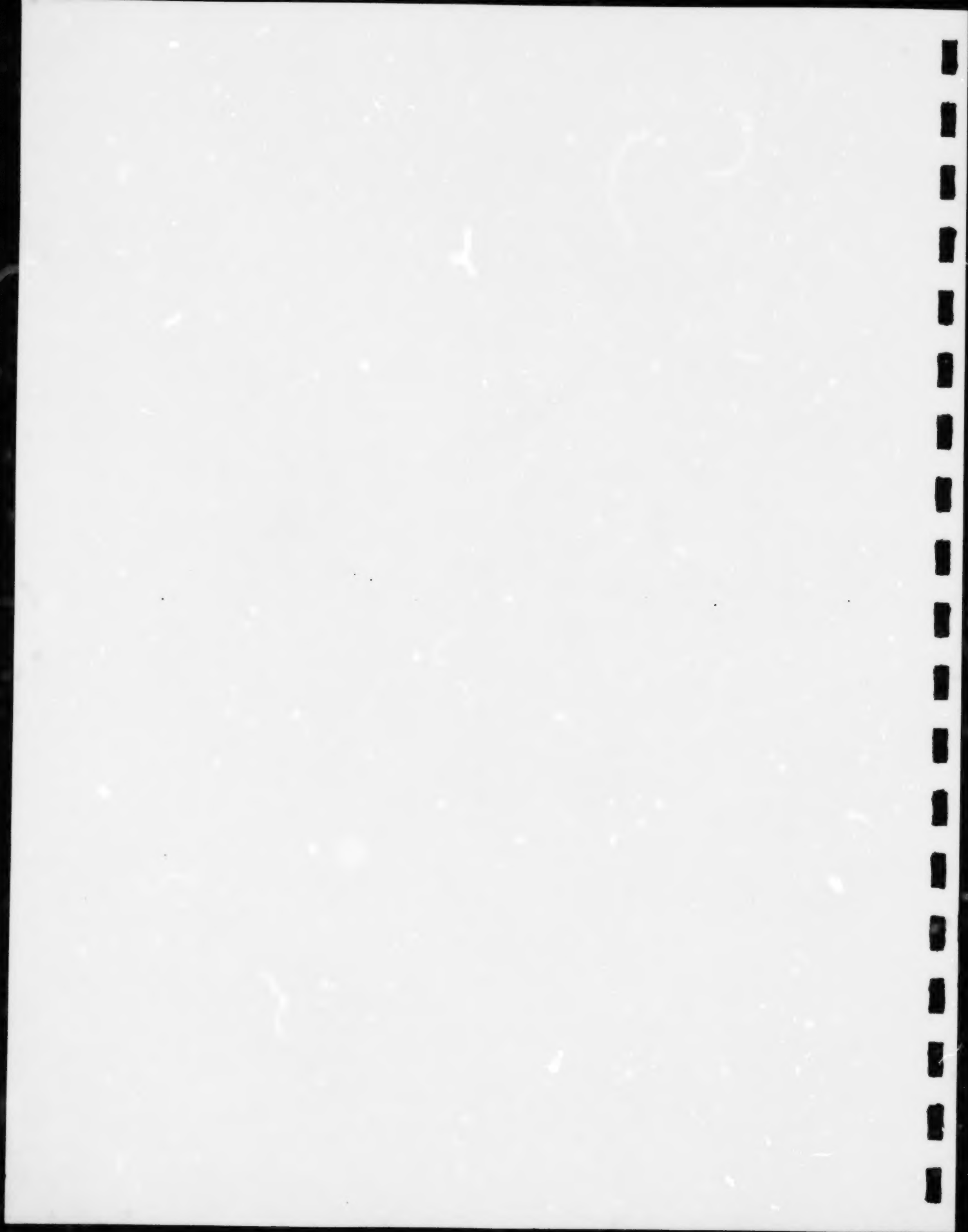
**Industrial/Scientific/
Technical Opportunity:**

Industry has supplied off the shelf automated test instruments for the provision of remote maintenance and monitoring system based on Coast Guard's requirements. Software package developed for the Arctic will be modified and enhanced to satisfy the requirements for the stations at Harrington Harbour and La Romaine. Industry will have the opportunity to provide the necessary hardware and software for the Research and Development system. Depending upon the results, the concept may be implemented on a larger scale with inherent opportunities for industry.

APPENDIX C.4

**Research and Development and Engineering Studies Plan
(RD&ES)**

Vessel Traffic Services (VTS)



Project Number: 2097

Key Result Area: Vessel Traffic Services

Project Title: Slow Scan Video Transmission

Project Officer: D.A. Learning, Coast Guard Surface Group
Ottawa, 998-5265

Contractor/Performer: -

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
	-	1	20	<u>21</u>
				21

Project Description: The objective of this proposal is to ensure safe and efficient navigation in Canadian waters. Slow scan video (SSV) is the least expensive technology of all transmission methods. The project will determine the operational and technical effectiveness and life cycle feasibility of SSV technologies on various waterway types.

This study foresees a detailed evaluation and documentation of current technology. Assessments will be accomplished through lease for on-site trials, or, where more cost and time effective, testing of equipment using data gathered from existing operational systems. Alternatively, assessment could be undertaken at a Centre utilizing SSV.

Equipment evaluated will be restricted to that currently available on the market.

Status: -

Reports/Deliverables: -

Industrial/Scientific/
Technical Opportunity: Throughout this project CG operational and technical personnel will be in contact with industry representatives of the Canadian and International market.

Project Number: 2098

Key Result Area: Vessel Traffic Services

Project Title: RADAR Extraction

Project Officer: D.A. Learning, Coast Guard Surface Group
Ottawa, 998-5265

Contractor/Performer: -

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	-	1	33	34
				34

Project Description: To determine the operational and technical effectiveness and life cycle feasibility of new radar extractor technologies on various waterway types under differing climatic conditions.

The scope of work will encompass the trial and evaluation of up to 3 extractor systems manufactured by different companies. Assessments will be accomplished through lease of systems for on-site trials, or, where more cost and time effective, testing of equipment using Coast Guard generated data at the manufacturer's plant.

Equipment evaluated will be restricted to that currently available on the market and share an extractor system shows promise, need may arise for long term assessment under field conditions.

Status: -

Reports/Deliverables: -

Industrial/Scientific/
Technical Opportunity: Through the course of this project, Canadian industry will be given equal opportunity to present domestic technology. Should this technology prove viable, Canada could benefit from the development of unique expertise in extractor technology.

Project Number: 2099

Key Result Area: Vessel Traffic Services

Project Title: Regional VTS Master Plan

Project Officer: D.A. Learning, Coast Guard Surface Group
Ottawa, 998-5265

Contractor/Performer: Bureau of Management Consultants

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	-	41	40	81
				81

Project Description: The project is geared to updating the COG LTCP component through integration of all appropriate demand/supply/operational and cost benefit analysis.

In order to update and provide additional information on the COG LTCP we are now involved in the development of the detailed Capital Investment Plans (CIPs). Whereas the VTS National Study methodology is the basic planning framework, its completion in 1985 makes necessary the updating of information to reflect changes since original publication.

As part of the process, VTS operational and technical site surveys and associated activities will have to be undertaken in CG regions. Different sites have been identified in the Central Region (Sarnia zone), and Maritimes Region (Fundy zone) where additional information traffic volumes and equipment performance is required. These site surveys (operational and technical), being an intrinsic element of the detailed VTS capital planning process, will be done at locations where deficiencies in traffic information is known to exist and as well where there is a sharp awareness of management problem spots.

Status: -

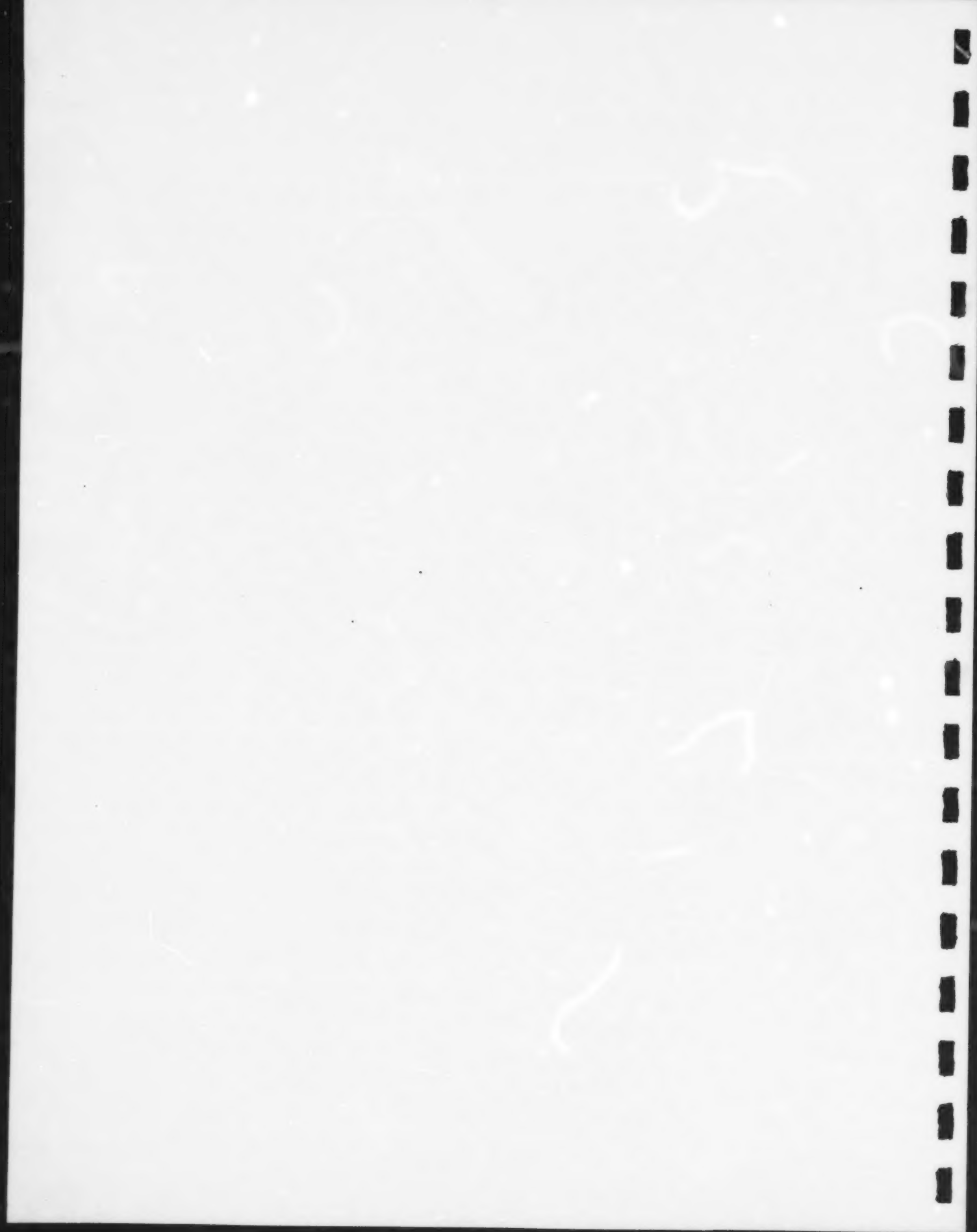
Reports/Deliverables: -

**Industrial/Scientific/
Technical Opportunity:** The plan will expose the element of the long term plan such that industry can effectively develop conceptual systems and equipment complements. The potential will be presented for consultation on the part of industry towards addressing problematical sites. Industry will also be provided with indications of future needs towards their own development of R&D programmes.

APPENDIX C.5

Research and Development and Engineering Studies Plan
(RD&ES)

Emergencies



Project Number: 2112

Key Result Area: Emergencies

Project Title: Disposal of Recovered Oil by Incineration

Project Officer: Mr. E. Gauthier, Coast Guard Emergencies
Ottawa, 990-3376

Contractor/Performer: S.L. Ross Environmental Research Limited

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	-	22	-	<u>22</u>
				22

Project Description: The purpose of this project is to attend to the minimization of environmental damage resulting from vessel source pollution. The study will involve three tasks:

1. determination of desired operating characteristics, such as weight, size, throughout, viscosity limitations etc.;
2. assessment of existing technology in terms of the desired operating characteristics; and
3. recommendations on best available technology and modifications to meet the criteria.

Status: Project completed under budget.

Reports/Deliverables: A Study of Equipment and Techniques to Dispose of Oily Materials from Spill Cleanup.

The final report has highlighted certain areas where further study is warranted. The report will assist us in prioritizing development projects for new operation incineration systems.

Industrial/Scientific/
Technical Opportunity: The information gathered and analysed through this project will prove useful for future contingency planning purposes.

Project Number: 2141

Key Result Area: Emergencies

Project Title: Oil Harvester

Project Officer: Mr. J.R.E. Gauthier, Coast Guard Emergencies
Ottawa, 990-3376

Contractor/Performer: DEW Engineering and Development Limited

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
	44	3	-	47
				47

Project Description: Improve the design of the existing Coast Guard "Oil Harvester" by widening it from a 20' width to that of the 36' Slicklicker. Conduct comparison trials in a static mode to evaluate the recovery potential of the "Harvester" versus that of the Slicklicker.

Status: The development of the improved Oil Harvester was completed on schedule and delivered to CG Base Prescott on 20th February 1987.

Performance trials of the prototype were successfully conducted over the next two days with satisfying results in all aspects of operations, albeit with some minor start-up modifications which were accomplished on-site without incurring undue stoppage or additional project cost.

The "Oil Harvester" performance during the trials exceeded our most optimistic expectations by recovering a barrel of bunker C every 23 seconds on average. This and the possibility of a recovery device equal to or exceeding the recovery rate of the ubiquitous slicklicker at half of the latter's manufacturing cost makes the "Oil Harvester" a viable alternative or complement to our existing equipment.

Reports/Deliverables: Final Report - Engineering studies and Evaluation of the "Oil Harvester", March, 1987.

**Industrial/Scientific/
Technical Opportunity:** The further development of the "Oil Harvester" will enhance Coast Guard ability to obtain timely replacements for outdated or work out machinery. Also, there exists a potential for commercial markets and the attendant expansion of employment in the industrial sector.

Project Number: 2743

Key Result Area: Emergencies

Project Title: Countermeasures for Marine Spills of Hazardous Materials

Project Officer: Mr. E. Gauthier, Coast Guard Emergencies
Ottawa, 990-3376

Contractor/Performer: N/A

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
	-	72	-	<u>72</u>
				72

Project Description:

The objective of this project is to minimize environmental damage resulting from hazardous materials spills from ships. The work will be conducted in two phases. The first phase would be to conduct a risk analysis of marine spills involving hazardous materials starting with a survey of chemicals transported in Canada's navigable waters. The damage potential factor would be determined on the basis of the toxicity of the spilled chemical, the environmental sensitivity of transportation routes, the risk to human populations, etc. The second phase of the project would be to select, in conjunction with the Coast Guard contract manager a number of hazardous materials on the top of the priority list, and to perform a detailed countermeasures study of methods and equipment for dealing with spills involving these chemicals. The end result will be a series of chemical-specific recommendations for the Coast Guard in terms of response strategies, contingency plans, and equipment and training requirements.

Status: -

Reports/Deliverables: A written report detailing response techniques and equipment to investigate environmental damage by Hazmat spill will be published in limited quantities for interdepartmental use.

**Industrial/Scientific/
Technical Opportunity:** An opportunity for the scientific community to obtain and process data relating to clean-up of hazardous spills. This would further enhance industry's clean-up potential.

APPENDIX C.6

Research and Development and Engineering Studies Plan
(RD&ES)

Waterways Development, Maintenance and Protection

Project Number: 2149

Key Result Area: Waterways Development, Maintenance and Protection

Project Title: Sediment Transport Model for Sinuous Rivers

Project Officer: Mr. N.E. Eryuzlu, Coast Guard Aids and Waterways,
Ottawa, 998-1380

Contractor/Performer: Western Canada Hydraulics Laboratory Limited

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
CCG	28	1	-	29
DSS	14	-	-	<u>14</u>
				43

Project Description: Develop a generalized mathematical computer model to provide a method of estimating sediment movements in Sinuous rivers. The main computer program would be developed with trial tests.

Status: The first phase, a mathematical computer model for sediment transport in Sinuous rivers, was successfully developed by the consultant and has been reviewed and accepted by the Department. Further testing, refinement and development of the model is continuing for eventual Regional applications. Project completion is planned for 1989/90.

Reports/Deliverables: TP-8325E, Mathematical Model of Sediment Transport in Sinuous rivers.

**Industrial/Scientific/
Technical Opportunity:** Benefits are expected in mission-related knowledge and planning procedures. The project could, however, reach the state of being useful to other federal departments as well as industry.

Project Number: 2422

Key Result Area: Waterways Development, Maintenance and Protection

Project Title: Liverpool Harbour Model Study

Project Officer: Mr. N.E. Eryuzlu, Coast Guard Aids and Waterways,
Ottawa, 998-1380

Contractor/Performer: Ocean Chem Limited
Inter-Cite Video

Financial Schedule:	<u>Previous</u> <u>Years</u>	<u>87/88</u> <u> </u>	<u>Future</u> <u>Years</u>	<u>TEC</u> <u> </u>
	160	7	-	<u>167</u>
				167

Project Description: A scale model of the site surroundings has been constructed at the Hydraulics Research Centre. The work consists of simulation of the sedimentation processes as they occur in the present state of the harbour and testing remedial alternations/structures that will improve on feasibility of tested/proposed modification(s) and their practicality in view of operations.

Status: All testing was completed as planned and preliminary conclusions and recommendations were drawn; draft report is being finalized while discussions with the Region and Public Works Canada continue.

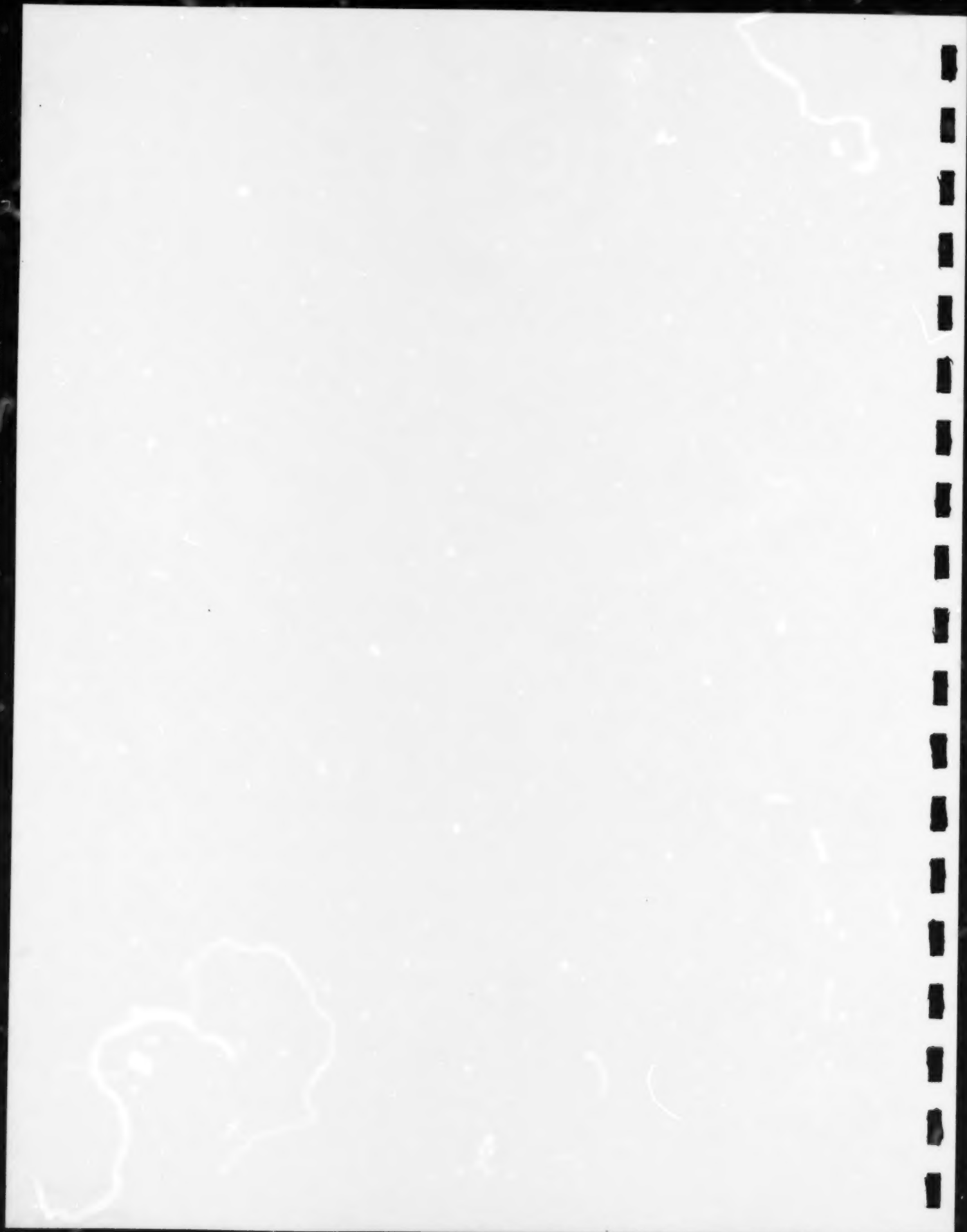
Reports/Deliverables: TP 7935, Field Data Collection, September 1986

**Industrial/Scientific/
Technical Opportunity:** The improvement of the available water depth would benefit the harbour operations and local industry.

APPENDIX C.7

Research and Development and Engineering Studies Plan
(RD&ES)

Search and Rescue Operations



Project Number: 2442

Key Result Area: Search & Rescue Operations

Project Title: 406 MHz EPIRB Investigations

Project Officer: Mr. W. Zuck, Coast Guard Telecommunications and Electronics, Ottawa, 998-1528

Contractor/Performer: Electrochemical Science & Technology Centre
Bureau of Management Consulting

Financial Schedule:	<u>Previous</u> <u>Years</u>	<u>87/88</u>	<u>Future</u> <u>Years</u>	<u>TEC</u>
	-	31	60	91
				91

Project Description: The project is directly related to enhancing SAR capabilities and services to the general public through more reliable installed EPIRBs and a quicker response time in the location of emergencies. This would be accomplished by ensuring proper EPIRB functioning through annual inspections and through the establishment of a homing/direction finding device to improve search and rescue response times.

The work consists of in house and contracted field evaluations, including land and shipboard sea trials where possible to determine signal strength and the relative probability of success at effective homing and retrieval of a 406 MHz EPIRB.

Status: Battery Study/Review and 406 MHz type approval procedures both completed satisfactorily. The study to identify power sources for the EPIRB yielded results that will be incorporated in the EPIRB Performance Standard.

Reports/Deliverables: A study to identify suitable power sources for the 406 MHz EPIRB.

Emergency Position Indicating Radio Beacon Type Approval Process.

**Industrial/Scientific/
Technical Opportunity:** This project will provide information to industry assisting them in their development of 406 MHz EPIRBs in the future.

Project Number: 2741

Key Result Area: Search & Rescue Operations

Project Title: Optimal Visual and Electronic Sweep Width
in Advanced Sea States

Project Officer: A. Armstrong, Coast Guard Search & Rescue
Ottawa, 990-3122

Contractor/Performer: Nordco Limited

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
COG	-	201	49	250
TDC	50	-	30	<u>80</u>
				330

Project Description: The main objectives of this project are

- collect data to enhance visual and electronic lateral range parameter regression in advanced sea state conditions;
- provide information on the optimum detection technology for use by COG SAR units;
- define and revise search procedures.

A 40 day offshore experiment will be conducted in inclement sea conditions off the east coast of Newfoundland. The process will involve intense data gathering followed by a regression analysis of the multiple variables in the acquired data to produce lateral range parameters for the existing conditions and type of search mechanism.

The project is limited to a number of specific off-the-shelf technologies and will not provide a guarantee of ongoing research efforts save that the final report will provide for development of, and planning and costing for, a future experiment. Ongoing research will be a factor of the validity of acquired data, results of regression analysis and managerial/-operational review of the final report.

Status: -

Reports/Deliverables: -

**Industrial/Scientific/
Technical Opportunity:** The project will provide increased knowledge of search parameters and the most effective combination of visual and electronic detection and procedures to use. The knowledge transfer in Canada will be achieved through modification and amendment of procedural manuals, nautical publications and software. International transfer of acquired knowledge will be achieved through submissions to IMO and thence member countries. Business and financial risks are negligible. Technical risk is moderate due to the potential severity of the environment in which the experiment will be conducted and the associated effects upon equipment, personnel and resources.

APPENDIX C.8

Research and Development and Engineering Studies Plan
(RD&ES)

Direction and Administration

Project Number: 2739

Key Result Area: Direction and Administration

Project Title: International Technological Developments in the Field of Marine Transportation

Project Officer: Mr. W. Ellwood, Coast Guard Executive Services
Ottawa, 990-3087

Contractor/Performer: Wartsila Marine Inc.

Financial Schedule:	Previous <u>Years</u>	87/88 <u> </u>	Future <u>Years</u>	TEC <u> </u>
	-	15	15	<u>30</u>
				30

Project Description: The purpose of the project is to update the publication (TP 2753) to reflect the current trends and prospects as evidenced in world literature and operational experience (scientific). By conducting literature reviews, drawing upon in-house expertise and conducting interviews with federal, industrial and university officials, the new report will be able to identify and outline the emerging technologies which may impact operations significantly into the future. Graphs and flow charts will be utilized to highlight issues and to demonstrate the logical evolution of issues (in time).

Status: Completion date is expected to be October 31, 1988.

Reports/Deliverables: The output will consist of an updated and revised text covering the subject matter in both official languages and professionally edited to publication standards. The report will be distributed both within CG and to outside contacts including the Marine Advisory Board (TP-2753).

Industrial/Scientific/
Technical Opportunity: N/A

APPENDIX D

Program for Energy Research and Development
(PERD)

APPENDIX D

1987/88 PERD BY KEY RESULT AREA
(KRA) AND SOURCE OF FUNDS

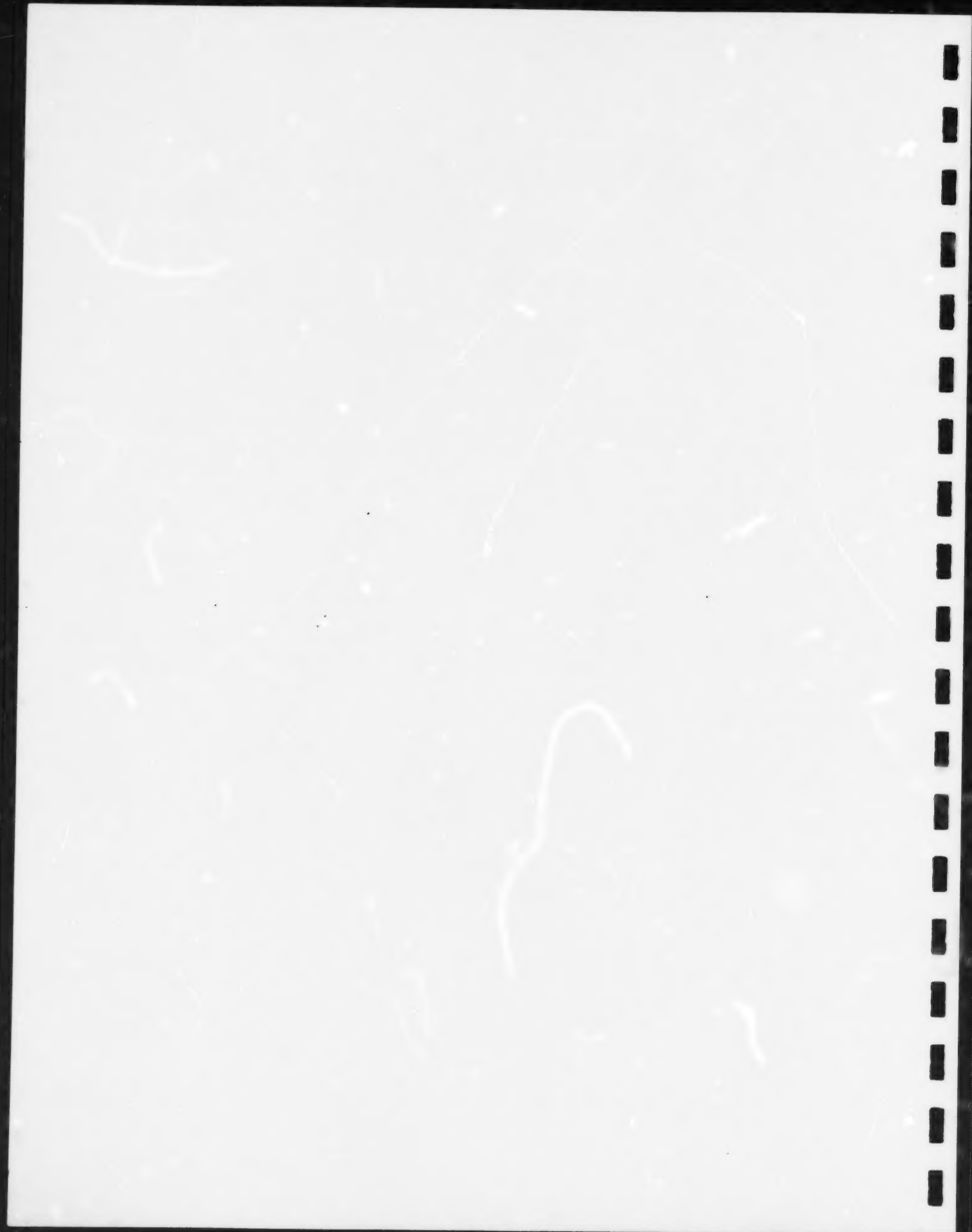
KRA	PERD 000's	OTHER* 000's	TOTAL
Arctic R&D: Safety & Regulatory	941	257	1,198

* Other is \$92K from COG and \$105K from NRC for Ice Crushing project.

1987/88 PROGRAM SUMMARY BY PROJECT
AND KEY RESULT AREA .

KRA	PROJECT #	PROJECT TITLE	1987/88 EXPENDITURES 000's
Arctic Research & Development	2194A	Shipboard Ice Navigation Support System (SINSS) Phase V	450
	2194B	Vessel Performance and Trafficability	360
	2082	Ice Crushing by Indentation	237
	2238-1	Year Round Accessibility of the Beaufort Sea via the Southern Route of the NW Passage	97
	2238-2	Eastern Parry Channel Ice Regime Study	54
		TOTAL	1,198

* \$92K COG
\$40K OERD
\$105K NRC



Project Number: 2194A

Key Result Area: Arctic Research and Development

Project Title: Shipboard Ice Navigation Support System
(SINSS) Phase V

Project Officer: Mr. W. Ellwood, Coast Guard Executive Services
Ottawa, 990-3087

Contractor/Performer: Canarctic Shipping Co. Limited

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
OERD	778	450	-	1,228.
				1,228

Project Description: The primary objective of Phase V was to implement and operationally assess a first generation SINSS and to train the MV Arctic Navigation Officers in the use of the System.

Status: Completed.

Reports/Deliverables: TP 9215-E - Phase V Final Report - Shipboard Ice Navigation Support System, March 1988.

**Industrial/Scientific/
Technical Opportunity:** The development of the SINSS System will be of major assistance to ships operating in the Arctic.

Project Number: 2194B

Key Result Area: Arctic Research and Development

Project Title: Vessel Performance and Trafficability

Project Officer: Mr. W. Ellwood, Coast Guard Executive Services
Ottawa, 990-3087

Contractor/Performer: Canarctic Shipping Co. Limited (subcontracted to
Norland Science and Engineering Ltd.)

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
	-	60	-	60
	928	300	400	<u>1,628</u>
				1,688

Project Description: To provide a comprehensive review of the ice data collected on board MV Arctic during the 1987 navigation environment on vessel performance. To describe and relate the 1987 data to be historical data base covering all Canadian Arctic voyages of MV Arctic between 1983-87.

Status: Completed.

Reports/Deliverables: TP 9063-E, Seasonal and Historical Analysis of the MV Arctic Vessel Performance and Trafficability Data Base, 1983-87 (Vol. 1) Vessel Performance and Trafficability Study for the MV Arctic 1987 Trading Season, (Vol. 2) Norland Science and Engineering Ltd., Canarctic Shipping Co. Ltd., March 1988.

**Industrial/Scientific/
Technical Opportunity:** Data collected will benefit future ship designs.

Project Number: RDE 2082 (AWRSP 2074)

Key Result Area: Arctic Research and Development

Project Title: Ice Crushing by Indentation

Project Officer: J.S. McCallum, Coast Guard Northern,
Ottawa, 991-6001
W. Ellwood, Coast Guard Executive Services,
Ottawa, 990-3087

Contractor/Performer: National Research Council, Institute for Research in
Construction

Financial Schedule:

	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
COG	-	92	50	142
OERD	-	40	130	170
NRC	-	105	300	<u>405</u>
				717

Project Description: The objective of this project is to investigate the mechanisms involved in the ice crushing part of the process of structure/ice or ship/ice interaction during impact in order to better understand and more accurately quantify the associated forces.

Status: Active.

Reports/Deliverables: Ice Crushing by Impact and Indentation, a Literature Review, February 1988.

**Industrial/Scientific/
Technical Opportunity:** The project will result in a major advance in ship/ice interaction dynamics and a major advance in dynamic modelling of ships generally. The technology can be applied to the study of wave loads.

Project Number: RDE 2238-1

Key Result Area: Arctic Research and Development

Project Title: Year Round Accessibility of the Beaufort Sea via the Southern Route of the North West Passage

Project Officer: W. Ellwood, Coast Guard Executive Services,
Ottawa, 990-3087

Contractor/Performer: Canarctic Shipping Co. Ltd.

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
OERD	-	97	-	97
				97

Project Description: To investigate the ice and navigational environment of the Southern route of the North West Passage that may impede year-round navigation by ice-breaking oil tankers. The deep water route via Prince of Wales Strait is also being studied to provide a comparison of ice conditions of this area as an alternate route.

Status: Phase I completed, March 1988. Phase II will be implemented in 1988/89.

Reports/Deliverables: Phase I, Milestone Report #2, Year-Round Accessibility of the Beaufort Sea from the East via the Southern Route of the Northwest Passage.

**Industrial/Scientific/
Technical Opportunity:** N/A

Project Number: RDE 2238-2

Key Result Area: Arctic Research and Development

Project Title: Eastern Parry Channel Ice Regime Study

Project Officer: W. Ellwood, Coast Guard Executive Services,
Ottawa, 990-3087

Contractor/Performer: Canarctic Shipping Co. Ltd.

Financial Schedule:	<u>Previous Years</u>	<u>87/88</u>	<u>Future Years</u>	<u>TEC</u>
OERD	-	54	-	<u>54</u>
				54

Project Description: To investigate the reasons why ice conditions in the Eastern Parry Channel in the early winter and early spring are more onerous than previously expected. Phase I consisted of collection and analysis of SAR data for the area being investigated.

Status: Phase I completed, March 1988. Phase II will be implemented in 1988/89.

Reports/Deliverables: Phase I, Milestone Report #2, Eastern Parry Channel Winter Ice Regime Study, Phase I.

**Industrial/Scientific/
Technical Opportunity:** N/A

APPENDIX E

**Unsolicited Proposals (UPs) Sponsored/Funded
by CCG in 1987/88**

DSS UNSOLICITED PROPOSALS PROGRAM

Proposals Sponsored and Funded in 1987/88

		87/88	88/89	OTHER	TEC
UP No. A7-025					
Structural Steels for Arctic Class Ships	DSS	28	60	-	88
	COG/AWRSP	-	100	50	150
	EMR	-	-	50	<u>50</u>
- Arctec Canada Limited -					288
UP No. B7-006		87/88	88/89	OTHER	TEC
Sea Ice SAR Signature Analysis and Interpretation Manual	COG/AWRSP	25	-	-	25
	DOE	35	-	-	<u>35</u>
- F.G. Bercha & Associates (Alberta) Ltd. -					60
UP No. M7-014		87/88	88/89	OTHER	TEC
To Design, Construct and Test an Arctic Survival Sled	DSS	25	-	-	25
	COG/AWRSP	16	-	-	16
	TDC	9	-	-	<u>9</u>
- Melville Shipping Ltd. -					50
UP No. M7-025		87/88	88/89	OTHER	TEC
The Sea Ice Climate of the Northumberland Strait Crossing Project	DSS	285	-	-	285
	COG/AWRSP	-	10	-	10
	DPW	150	-	-	150
	DFO	-	40	-	40
	ACQA	-	135	-	<u>135</u>
- MacLaren Plansearch Ltd. -					620
UP No. P7-015		87/88	88/89	OTHER	TEC
Marine Access to Northern Sites During Polar 8 Operation in Arctic Waters Phase I: Description of Sites & Regions, and Database Development	COG/AWRSP	60	94	-	154
- Polar Sea Research Ltd., & Norland Science and Engineering Ltd. -					154
UP No. T7-007		87/88	88/89	OTHER	TEC
Development of a Comprehensive Numerical River Ice Model	DSS	90	210	60	360
	COG/RD&ES	-	55	35	90
	DOE	-	35	-	35
	DIAND	-	-	30	<u>30</u>
- Tecsalt Inc. -					515

DSS UNSOLICITED PROPOSALS PROGRAM

Proposals Sponsored in 1987/88 But Funded in Future Years

		88/89	89/90	TEC
UP No. B7-023				
The Development of a Rational	DSS	42	-	42
Breakwater Design Procedures for	COG/RD&ES	30	-	30
Concrete Armour Units				
- W.F. Baird & Associates Coastal				72
Engineers Ltd. -				

Proposals Sponsored in 1987/88 But Funded in Future Years

		87/88	88/89	OTHER	TEC
UP No. A6-023					
Study of the Effect of Weld Metal	DSS	38	-	-	38
Composition on its Sea Water	COG/FCIP	25	5	-	30
Corrosion Resistance and Toughness	EMR	10	10	-	20
- Arctec Canada Ltd. -					88

		87/88	88/89	OTHER	TEC
UP No. A6-037					
Effect of Welding Process and	DSS	25	-	-	25
Parameters on Weldability of	COG/FCIP	30	70	-	100
Selected Primers	EMR	15	-	-	15
- Arctec Canada Ltd. -					140

		87/88	88/89	OTHER	TEC
UP No. A6-050					
Ice Flow & Blockage Investigation	DSS	67	-	-	67
of Shrouded Propellers	COG/FCIP	-	70	-	70
	TDC	80	-	-	80
- Arctic Research & Development Ltd. -					217

		87/88	88/89	OTHER	TEC
UP No. B6-024					
Arctic Structures Corrosion	DSS	70	-	-	70
	COG/AWRSP	2	27	-	29
	EMR	20	-	-	20
	TDC	-	25	-	25
- F.G. Bercha and Associates					144
(Alberta) Limited -					

		87/88	88/89	OTHER	TEC
UP No. B6-217					
Investigations into Noise Control	DSS	40	-	-	40
Policies, Techniques and Materials	COG/RD&ES	10	8	-	18
for Marine Vessels					
- Harford Kennedy, Lyzun Ltd. -					58

DSS UNSOLICITED PROPOSALS PROGRAM

Proposals Sponsored in Previous Years for which 1987/88 CCG Funds were Allocated

		87/88	88/89	OTHER	TEC
UP No. M5-021					
Archive All Current Meter Data	DSS	20	-	-	20
Collected During Offshore Drilling	CCG/RD&ES	10	-	-	10
Operations on the Scotian Shelf	DFO	12	-	-	12
- MacLaren Plansearch Ltd. -					42

		86/87	87/88	88/89	OTHER	TEC
UP No. O6-220-1						
Reduced Visibility/Buoy Laying and	DSS	500	-	-	-	500
Checking	CCG/FCIP	-	62	-	-	62
	TDC	-	240	-	-	240
- Offshore Survey Ltd. -						802

		87/88	88/89	OTHER	TEC
UP No. W6-014DP					
The Development and Incorporation of	DSS	100	200	-	300
New Technology into our Marine	CCG/FCIP	-	55	-	55
- Wagner Engineering Ltd. -					355

PROPOSALS SUBMITTED DIRECTLY TO CCG

Proposals Sponsored in Previous Years for which 1987/88 CCG Funds were Allocated

		87/88	88/89	OTHER	TEC
UP No. B6-024					
Arctic Utility & Support	CCG/FCIP	750	750	-	1500
Vehicle - ARKTOS BETA					
- Watercraft Offshore Canada Ltd. -					1500

APPENDIX F

R&D Management Publications

List of R&D Management Publications

- TP 6819 Managerial Handbook for the Financial Control And
 Status Reporting of Research and Development
 Projects
- TP 6570 CCG R&D Contracting Guidelines For Project
 Managers
- TP 6569 CCG Research & Development Publication Standards
 For Contractors
- TP 7370 Unsolicited Proposals (UP's) Guidelines and
 Procedures

APPENDIX G

List of Reports

List of Reports:

Project Number

AWRSP:

- 2071 TP 9157 - Strength and Stability of Framing for Ice Strengthening, Fleet Technology Ltd., March 1988.
- 2074 TP 8680E - Analysis of Ice Penetration Data in Support of Parametric Physical Modelling.
- TP 7976E - Continuation of Parametric Model Study of MV Arctic Hydroelectric Response During Multi-Year Ice Impacts.
- 2082 Ice Failure by Impact and Indentation - A Literature Review, Ian Jordaan and Associates (Report prepared for National Research Council), February 1988.
- 2083 TP 8890E - Arctic Shipping Pollution Prevention Regulations, Ice Regime Project, Case Studies of the Ice Numeral Concept, Polar Sea Research/Norland Science and Eng. Ltd., November 1987.
- Ice Regime Field Project Eureka and Bent Horn voyages, 1987. Vol. 1 - Shipboard Observations, Eureka Voyage. Vol. 2 - Shipboard Observations, Bent Horn Voyage. Vol. 3 - Data report; Polar Sea Research/Norland Science and Eng. Ltd., March 1988. (Draft only)
- Evaluation of the Effects of Ice Regime Qualifiers on Ship Entry Decisions, Norland Science and Engineering Ltd./ Polar Sea Research Ltd., April 1988.
- 2084 TP 9158 - Arctic Survival Equipment Tests 1987/88, Melville Shipping Co. Ltd., March 1988.
- TP 8825 - Ship Evacuation Trials in Ice Covered Waters.
- 2085 A Ship Abandonment Survival Guide for Arctic Mariners (Chapter 1-3), Melville Shipping Co. Ltd., March 1988.
- 2086 Update of the Arctic SAR Database, Fleet Technology Ltd., April 1988. (Draft)
- 2090 See listing for Energy R&D project 2194 B.
- 2091 TP 8952 - Assessment of Trafficability and Vessel Manoeuvring and Structural Performance in a Mixed Old Ice Regime, Canarctic Shipping Co. Ltd., March 1988.
- 2447 TP 9026 - Feasibility Study on an Applied Research Program into Steering Gear and Rudder Design Criteria for Commercial Arctic Vessels. Vol. 1 - Final Report, Vol. 2 - Appendices (Appendices are protected), Canarctic Shipping Co. Ltd., March 1988.

List of Reports

Project Number

FCIP

- 2920 TP 8269E/F - Evaluation of the Performance of a Modern Commercial Icebreaker, Vol. I & II, February 1987.
- 2982 "Miranda" Davit Launch/Recovery System for Rigid Hull Inflatable (RHI) Boats, The Cord Group Limited, March 1988

RD&ES

- 2122 A Study of Equipment and Techniques to Dispose of Oily Materials from Spill Cleanup, S.L. Ross Environmental Research Ltd.
- 2126 System Manual for LORAN-C Data Acquisition System, July 1987.
- 2132 Evaluation of Ship Location and Reporting System, July 1988.
- 2141 Engineering Studies Evaluation of the "Oil Harvester", DEW Engineering and Development Limited, March 1987.
- 2149 TP 8325E - Mathematical Model of Sediment Transport in Sinuous Rivers, Western Canada Hydraulics Laboratory Limited
- 2161 Interim Report on Phase I (theoretical calculations).
- 2162 Interim Report on the Theoretical Calculation of Visual Ranges, March 1987.
- Final Report, March 1988.
- 2163 Prototype Buoy Cleaning and Painting Equipment, Final Report, December 1987.
- 2268 Report on Coast Guard buoy cleaning and painting facilities at the Bases used for test paint applications
- 2281 Offshore Testing of Booms and Skimmers, S.L. Ross Environmental Research Limited.

List of Reports

Project Number

- 2321 TP 8937E - Test and Evaluation: "Seabeacon" Mark III,
Vol. 1 and 2.
- 2422 TP 7935 - Field Collection Data, September, 1986, Ocean Chem
Limited
- 2444 Report on NAVTEX Research and Development Project.
- 2446 System Manual Documentation Applicable to Killinek and
Harrington Harbour, April 1988.

Energy R&D (PERD)

- 2194A TP 9215E - Phase V Final Report - Shipboard Ice Navigation Support
System, Canarctic Shipping Co. Ltd., March 1988.
- 2194B TP 9063E - Seasonal and Historical Analysis of the MV Arctic Vessel
Performance and Trafficability Data Base, 1983-87 (Vol.
1). Vessel Performance and Trafficability Study for the
MV Arctic 1987 Trading Season (Vol. 2), Canarctic
Shipping Co. Ltd., Norland Science and Engineering Ltd.,
March 1988.
- 2082 Ice Crushing by Impact and Indentation, a Literature
Review, Ian Jordaan and Associates, Inc., February 1988.
(Also listed under AWRSP project 2074).
- 2238-1 Phase I, Milestone Report #2, Year-Round Accessibility
of the Beaufort Sea from the East via the Southern route
of the Northwest Passage.
- 2238-2 Phase I, Milestone Report #2, Eastern Parry Channel
Winter Ice Regime Study, Phase I.